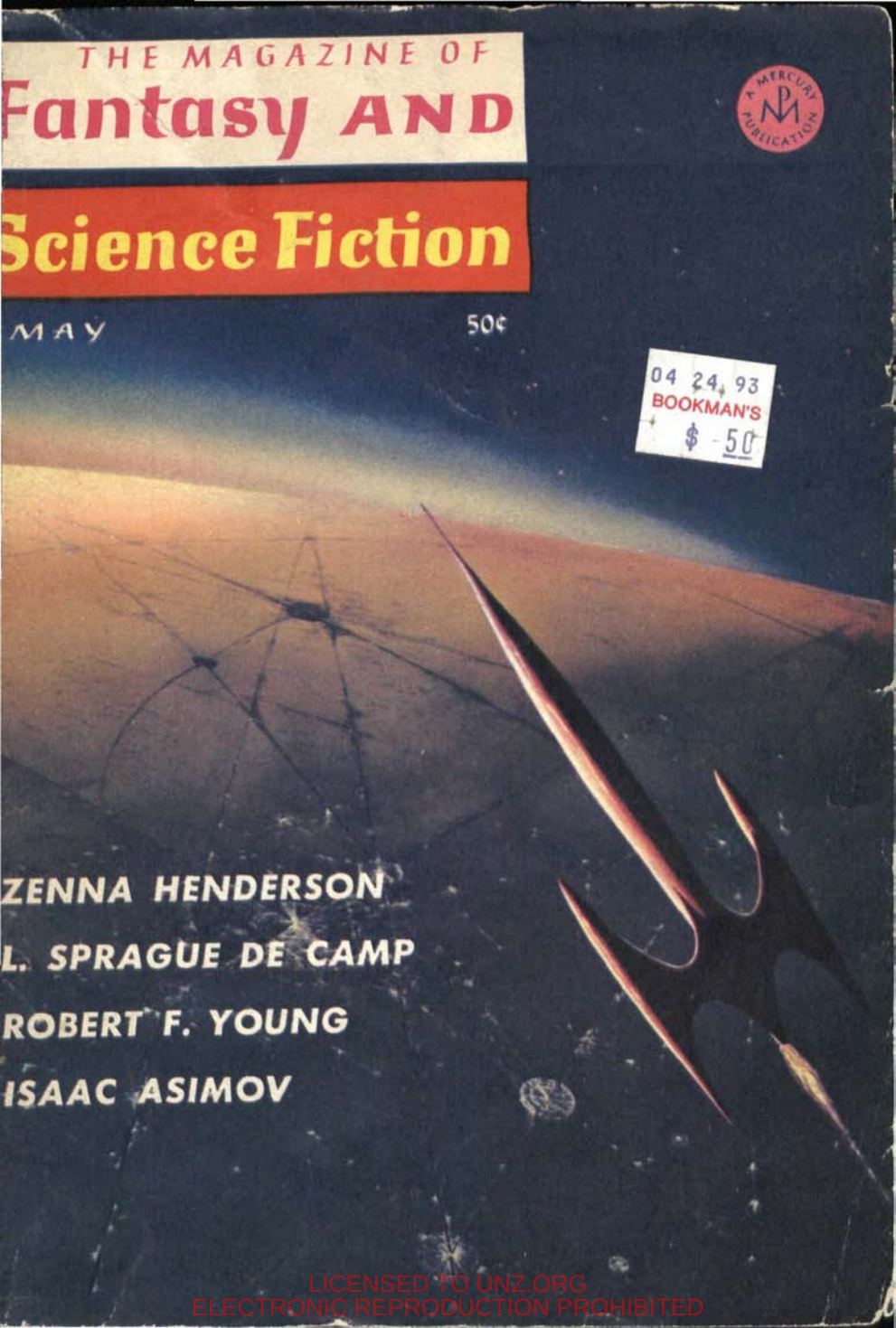

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Fantasy and Science Fiction

MAY *Including Venture Science Fiction*

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Unlike a recently semi-defunct paperback book house whose emphatic motto was to the effect that their imprint "Means Controversy," we here are content merely if our stories are good. Sometimes, though, they are controversial as well. Robert A. Heinlein's GLORY ROAD (July-Sept. 1963), for example, and Ray Nelson's TURN OFF THE SKY (August 1963) were both in this class. We predict with confidence that this second story by math student Norman Kagan (FOUR BRANDS OF IMPOSSIBLE, Sept. 1964) will prove more controversial than either. Asked if he believed in immortality, Aaron Burr (and who more controversial than he!) replied, "On that subject I am coy." Do not ask, then, where we ourselves stand on the viewpoint set forth in this shaking, furious, outraged tale of our space program: on that subject we are coy. Read—rage, then, if you will. But—read.

THE EARTH MERCHANTS

by Norman Kagan

"They (engineers) will find that it is much more enthusing to solve the problems of the lack of water in the United States than to send an expedition to the moon, that it is more exciting to work towards the solution of . . . (the) needs of the seven billion people who will live on this planet . . . then to make sure a rocket silo can stand a fifty-megaton bomb."

—*Professor M. G. Salvadori*
Columbia University, New York

I

THE YOUNG MAN WAS VERY happy when he learned to play tennis. It was an indication that his mind was still reasonably flexible, and hence that he might still be able to learn to make love.

I could only infer this, but it seemed fairly plausible. Obsolescence and old age are the primary fears of most people in the Age of Playboy, no matter what field you study. And the carefully calculated build-up we'd given the space scientist would've at least have pitted his mind with the burning acids that've scarred most of us. What I was going to do now would really gouge him.

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Though it wouldn't be hard. Most engineers are cowards these days.

I let him beat me twice, then licked him four times running. He was puffing and sweating at the end of the final set, so I led him over to the tables on the side of the hospital's sundeck. He said nothing at the view, which on this bright day illuminated every foot of the thirty miles or so which separated the hospital from the gantries and blockhouses of Cape Kennedy Spaceport.

"All right, doctor," said the young man. His face and body were an angry red, partly from the exercise, more from too much sun in the month he'd been recovering from a nervous breakdown. He brushed his blond hair back from his forehead, and squinted at me, almost angrily. "When are you going to let me out of here, and back on Project Leviathan?"

This had to be done exactly right. I had to have another vector to work with; his anger and impatience had to be composed with something exterior. But I had it, of course. I always insure myself; my favorite psychiatrist joke is about the headshrinker who had just cured a patient of kleptomania. "I've totally eliminated your morbid desire to steal," he told his patient confidently. "But just in case, be sure to pick me up a transistor radio."

"I'd better clear some things up first, Dr. Manheimer. First of all, I'm a—or, rather, I was—a clinical psychologist, but not from N.A.S.A. I'm from the Agency of State."

I could see the phrase "clod-hugger" jumped through his mind, lickety-split. Then his voice came out, flat and dead; "I thought the matter of my parents was settled. There were no remains after that mob of Asiatics got through with them."

"That's correct," I told him. "I was only tangentially involved in your case, through our Psychological Stalemate Branch. But it seems I'm the only clinician who is qualified to talk to you any more. Scientists in classified work who've had mental illnesses are automatically considered security risks. No one in the Defense Branch of the government will talk to you any more."

I let him think about that for a while. It was embarrassing, it was so easy to read him. The brilliant creative space engineer, looking for the fascinating challenge of modern technology. No North American Dynamics or General Aviation or International Business Mechanisms to guarantee pensions and paid vacations and whisper that genocide was patriotism.

"The F.B.I. has made the usual suggestion that you commit suicide," I added, offering him a government issue poison needle.

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His eyes widened, and his hand trembled, but I closed my fist in time. So he stood by the railing for a while, staring at launching pads of the filthy lunacy across the Banana River.

Presently he recalled that I was a psychologist, and spoke the thought that had been cycling through his crippled mind. "What will I do now?" he whispered.

"Not much," I told him flatly. "You can't do any sort of industrial work, and no one in the scientific branch of government will have you. You realize of course that nearly every multiversity in Fortress America is involved in classified research—so that lets teaching out. I suppose you could —" and I let my voice trail off. Only an insane therapist would talk in such a manner, of course.

"Or," I said quietly, "you could come to work for us."

"What're you?" he said after a moment. His eyes were still dazed.

I waited a precise four seconds —I'm not a master vector psychologist for nothing. "My name is Arlan Kadison," I told him briskly, "and I'm head of a new department in the Agency of State. I'm to set up better liaison between N.A.S.A., the Defense Branch of government, and the Agency. We hope that more space flight and defense spin-off can be applied to the agency's functions."

His face wrinkled up. *Clodhuggers.* But he had no real choice, of course. Those defense hotshots would soon learn the cost of their "security systems."

"There's a number of things I don't understand," he said slowly, the Texas burr soft in his voice. The broiling sun was making his face sweat. "What's 'spin-off,' and I don't recall exactly what the Agency of—"

"That's easy enough to answer," I replied, and allowed myself to relax a little. "Spin-off are the products of space flight science which turn out to have applications on the ground." He was nodding wisely, but my voice tightened as I said; "And the Agency of State? Why, even a space scientist like you should've remembered that. We're the part of the government charged with investigating the surface of Terra external to Fortress America. You know—like the rest of the earth."

With the kid inside the project, I let the deep probers chop into him. He'd work over the reports we'd dummied up, or answer the carefully phrased questions that passed for conversation in his section. We also let him have a nice little Eurasian secretary, named Chien-Shiung. Darkly smouldering, with skin like golden parchment, and fragile features. A real piece of class. She could apply her own special brand of intuition, while we built up the annoyances

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and frustrations for Phrase Two, conscious co-operation.

Meanwhile, I was busy. A seven million dollar Lunar supply mission had exploded on the Vandenberg Pads. It gave us our first test of propaganda efficiency, and I let Operations make a complete run. Project "Earth Merchants" was underway.

Which meant that I sat at my desk, a hairy middle aged-man with too much nose, blinking at my own beautiful secretary's sarong over dozens of research reports. Nevertheless, in our warren of offices in Underground, D.C. the pattern of a plan was emerging, a plan to cripple, paralyze, or destroy if necessary the space flight program of Fortress America.

Our main strategy became formalized—though it was clear to me as early as my meeting with Dr. Oliver Manheimer—a few days later. Our research chief, a straight medical psychiatrist named Dims, outlined his group's findings—

"It's amazing, Mr. Kadison," he said wild-eyed. "So much has been written, pro and con, and yet no one has really investigated the deep emotional 'whys' of astronautics."

"Go on, Sidney," I told him easily. I leaned back and waited. Dim's words came pouring out to fill my air-conditioned cave, while his thin-featured face jumped and twitched in agitation. I had to admit that he formulated his theory quite clearly.

"Well, of course we started with all the public statements; 'the destiny of mankind', 'endless conquest of the cosmos','noblest challenge to our species'. When people begin talking that way, any psychiatrist knows there's something dirty and guilty behind it." Dims stared at me brightly. "Like the ban-the-bomb societies. A product of national guilt. Because atom bombs were dropped. And *we* did it."

I nodded. Scientists are like that. They can only be pleased at what they find out. I bet Einstein and Nobel were cheerful when they made *their* big strikes, too.

"Go on, Dr. Dims." I lit up a cigar.

"It's a bit complicated from here on out," said Dims. "Basically, our clue came from science fiction—"

"Escape fiction," I murmered.

"Yes. Escape fiction, like sex magazines." He blushed. "Well, I don't really care to talk about that sort of stuff—

I made a bridge with my hands. "Well. . . ."

"But it's the key to our studies. Sex magazines are escape fiction. They let you into a world of beautiful women, lush and wild and aroused, long legs—uh, and like that. I mean to say, there is a second factor. The guilt feelings retained from childhood. These girls are clearly willing and eager, with faces of passion, dressed as a man might have commanded, so that they can *go*—"

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"Take it easy, Dr. Dims!" I cried. The poor man was red and breathing hard. I let him calm down for a minute or two.

"Ahem. Science fiction is too rich and complex a field to analyze completely, but certainly in a large number of stories, the reader is entranced by swift action, the sweep of reason and experiment, the deep complex concepts. This is an escape from our own world of bumbling progress, confused issues and tremendous organizations which require submission and obedience, and return boredom and money."

"S-F appeals particularly to scientists. Anyone who's worked in experimental science or engineering is familiar with the stumbling and groping, the mistakes, the waste, the projects and theories that don't pan out, the bureaucracy. Not to mention the insignificant, exacting and tedious work which most scientists and engineers wind up doing.

"So the first point is clear. Many scientists and technologists must find escape from their work. As one of them put it, 'in the stories the experiments work out.'

"Guilt, the second point, is also fairly obvious. Just look at all the Negros, American Indians, and Japanese in these space stories. Who cares if they all starve to death in real life! Look at all the fun they're having in the Space Patrol!"

Dims sat back and wiped his forehead, and I nodded again. He'd about summed it up. I suppose it would be hard to convince a lifelong fan of his theory. Anymore than you could convince a prize-fight fan that he was sublimating his blood-lust. Fortunately, I'd switched to sex magazines quite a few years ago.

"The point about guilt is valid, you know. In spite of all this talk about pure research, most scientists are convinced the space and defense efforts will not help many people on the earth."

He paused. "In fact, there's a growing recognition of this in S.F. It's generated an ugly countertrend. And it's growing," said Dims "More and more stories where planets are destroyed (usually with larger beams), where the masses are portrayed as degenerate and inferior. There's an excuse of many space civilizations, so you can cauterize at least one world. 'Who's civilized anyway?' says the space hero.

"Clearly this is an hysterical guilt compensation, a fantastic defense against the plain fact that billions are being spent on bombs and satellites and space bases, while most human beings are starving and miserable."

I put my cigar in the ashtray and leaned across the desk, looking hard at Dims. "All right, doctor," I said forcefully. "That's our analysis. I figured about as much from

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looking over our Dr. Manheimer. The question is, what do we do with it?"

"Well, of course," said the little man, "we could tell the truth."

"Ha! You really are an optimist!" I laughed. "Let's be reasonable. You know damn well we've got to use indirection and manipulation."

"Of course, of course," said the little guy. "Let me see—" His eyes grew vacant. "Well, any escape mechanism is unnatural, otherwise it wouldn't be an escape mechanism. It isn't perfect, it's not the original psychic apparatus. Therefore there's a tension set up. If we could manipulate this synthetic tension—"

"Sure, pal, you've practically got it already," I told him. "Let me have a full proposal in a week or so. Fine."

I shook his hand and sent him on his way. Things were going fine!

On the flight back from Seattle two months later I fell into a deep depression. Things were going well; the first mathematical model of the situation had been submitted to the Agency of State's computers, I had the first projections in my briefcase. I was no operations research expert, but as a vector psychologist, I knew something of sociomath; I could understand them. Project Earth Merchants had been operational just sixty days, half of that at a deep level.

The big ramjet climbed and then leveled out; around me the other passengers slept, read or watched stereo-vision with their own binoular-sets. Pampered and protected, the most coddled people on earth. Over two billion would go hungry this night.

I slumped in the chair. I was getting fat, getting old, getting ugly. I had never been handsome or strong. I realized that my second year in engineering school, it was one reason I quit. Why spend my life sweating over drafting boards, burning my fingers with a soldering iron, going blind reading technical journals, so a laser beam could torch a continent half a minute faster, or another of those handsome blond gods that rode the capsules could land on Mars a week sooner? Vicarious pleasure? Not for me!

I *had* had a wonderful time in the early Peace Corps, it was the greatest experience of my life, after my dearest Phong. It'd been magnificent there, sweating and struggling in the jungles (working with *people*, for God's sake!) making love in the dusk and under the stars, and it was there it had finally come to me. The work was honest, at least; I wasn't just another plug-in engineer scurrying each day to his little office in the missile plant.

I shouldn't feel guilty about the project, but in an unpleasantly deep way I did—it *had* been my idea. Internal schisms in government aren't unknown; there were

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the interservice rivalries back in the 1950s, and before that the Army and the A.E.C. fought it out for the control of atomic weapons. And there're about a billion cases from civics that I forget. Still, the knowledge of just what I was setting up made me uneasy. No one had ever set up one government agency for the express purpose of sabotaging another before. But I was right—I knew I was right!

I pulled out the computer results. They were a smear in the cone of radiance on my lap. I put on my heavy glasses, and on impulse pulled a personnel transfer card from my jacket. I'd run this to suit myself! The hell with playing it safe! The operations research analyst's name was on the report. I didn't need any of his mathematical goobledegook. I scrawled his name and classification code on the punchcard. The organization was finalized; no one but us would know for years, maybe forever. People like Manheimer and dopey Dims I could handle; soupy sociomathematicians with overriding powers on my directives were something else. Besides, I had twenty times the intuition he did.

The rams were silent, we were on the other side of their sound. Most of the other passengers were asleep. I extinguished my lamp.

It was a clear night. The stars came forth slowly.

I looked right up at them. Space had been good for some things. The orbital relays and weather scanners were useful, a few research projects had panned out. But astronautics was lunacy, now at any rate. Wait till a moon voyage didn't cost billions; better, wait till it didn't mean deprivation for millions. How could men travel out into the cosmos, travel closer to God perhaps meet other intelligences, when they did so at the price of torturing their brothers? Nothing of moral good could come of voyages at such a price.

Let the stars and planets wait. I let the chair fold back, and slept.

"This is a moral issue, and we are making the wrong choice. To race the Russians to the moon, and let our old people live on almost nothing is immoral. The moon is not science—not bread. It is a circus. The astronauts are the gladiators. It's lunacy, I say."

—Dr. Leo Szilard

II

The bright young man smiled across the conference room at me. Most of the other faces in the room were cheerful too, or at least gave that appearance. The main exception was my young friend, Dr. Oliver Manheimer. The ex-space scientist was glaring at me angrily. In a way, his face was very like the first time I'd seen it, at Cape Kennedy half a year before. Only two things kept him in check. One was my early statement that everything

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he would hear at this conference would be explained. The second, and much more important, was sitting prettily beside him, ravishing as ever—His new wife. Chien-Shiung's face glowed when he looked at her.

The young man said; "Since most scientists believe themselves to be rational, we've chosen to appeal to them with the following three arguments—"

He pulled placards up from the floor and placed them on an easel by his chair.

"*One*. That the money being invested in space flight is out of all proportion to the probable benefits. The idea is that we could get nearly as much useful data out of a much more modest program. As it is, analysis is almost seven years behind the millions of miles of telemetering tape we've got.

"*Second*: That scientific benefits are negligible in any case. Just think of what you could do with all the billions being spent on the Apollo III Project. All the fellowships, all the research grants, all the new schools. All Einstein and Descartes and Galois needed were pencil and paper. These crazy space nuts want to spend billions—"

"Go on, please," I told him. "Just skip the dramatics—*we're* already sold."

"*Third*: That it's just not worth the effort on *any* basis: That all that we'll get out of this whole mess and all we've gotten so far, is a bunch of television spectaculars and drawling team-heros. A lot of crap."

"Excuse me," said one of the men from the advertising agency we'd hired, "but that doesn't seem to carry much impact. Of course, with intellectuals—" he let his voice trail off.

"Oh, that's not the way it's going out in the mailings," said the young man, grinning. He picked up a form letter and read from it, sing-song—

"*Dear nuclear physicist;*

Did you spend six years sweating out your doctorate so you'd have to do without an accelerator for fundamental, basic particle research, so some space jockey could burn it up flying to Venus?

"Or listen to this one," he cried, waxing enthusiastic. "*Dear Mathematician;*

"*Are you wasting your best creative years? Too bad you couldn't get that grant to study at the Sorbonne, but we had to send some thermometers and movie cameras and other junk out Neptune-way . . .*

"How does this one sound?" "*Dear Professor;*

"*Not too many of your students interested in research these days, eh? Can't really blame 'em, though. there's a lot more of the long green in building robot freighters for our moon base—*"

A couple of the people at the table were chuckling. The copy-

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writer, who didn't appear very modest by nature, picked up some more cards.

"Of course," he continued, "with the scientists you at least have to *pretend* to be rational. On some of these others, though, we just let ourselves go—

"Dear Housewife;

"Would you like to see a man fly to Mars, if it meant your little baby might die of CANCER! It's horrible, but the money that might be spent on cancer research will be squandered on lunatic schemes to travel—"

"Listen to this one—

"Dear Elder Citizen;

"Hungry? Too bad that your social security allotment is so small, but just think, six months ago an astronaut circled Mars. He had a steak dinner the night before he blasted off—"

"—or this—

"Dear Citizen;

"Worried about automation? Don't be scared. There's now a manned satellite around the Moon. Too bad the money couldn't go for retraining the unemployed, especially if they go ahead and install that new computer where you work. Oh well, you can always have a breakdown—nearly one out of ten in Fortress America does these days. But you may not get much attention. Medical and psychiatric students can't get scholarships and goverenment loans and Civil Service Summer jobs—like astronautics majors. Oh well, you don't count anyhow. You've never even been to the orbital station—"

I couldn't seem to understand the young fellow very well, but I nodded at him and let him sit down. I could feel a headache coming on, they were getting more and more frequent nowdays. I turned to Dims, and motioned for his report. He stood. I could see great dark circles under his eyes, and his frame was thinner than his usual bird-like dimensions. It made him look alien, like some kind of grasshopper or one of those sand things the robots found on Mars.

"We have continued our program—" he began in a whisper, then cleared his throat and continued hoarsely. "Our program on our initial assumptions. According to the sociomathematical results and our own crude polls, they have been astonishingly effective. I believe that we've made contact with a basic element in the current personality, though our work with applications has left us little time for further basic work with the concepts."

He scrabbled around with the papers in front of him.

"The basic theme, of course, is that space flight and certain military functions are sublimations and vicarious activities. The notion has taken many forms. Uh, here," he said, picking up some scraps; "Why is a trip to the moon like self-abuse?"

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He told us, and set half the people at the conference table guffawing. I grinned myself, and Manheimer nearly blew his eyeballs out in self-control.

Despite Dims's weary voice, the jokes set us roaring. "What did the missile button-pusher tell his girl friend?" "How did the I.B.M. machine make its programmer obsolete?" "Why did the space technologist wear two sliderules?" Dims' psychologists had touched something in the basic nature of modern man. The trouble was, I became frightened when I tried to think about what it was.

I was so tired! Destroying a national institution takes a tremendous effort. Just think about how big a campaign you'd need to discredit baseball or mom's apple pie. And to control the wild side reactions, the effort had to go up exponentially with time.

I stared at the Agency of State computer analyses before me. They were now so complex, so larded with details and extra dimensions for counter-trends, that I could barely understand them. All I could see were dozens of curves with ex in their functions. In terms of society and real life, I now had no idea what the sociomath predicted. I reminded myself to requisition another operation researcher and sighed.

When sociological mathematics was synthesized out of operations research, macro-economics and statistical analysis back in the late 60s, many had seen it as the final tool needed to construct a scientific society. Who could have realized that it would be applied so often that the original, painfully-constructed models of society would become inaccurate and useless? Sociomath was still a valuable tool for the social scientist, but the best it could do in this topsy-turvy world was make crude approximations and predictions about social forces.

I swallowed half a dozen pills and turned my attention back to the conference.

"—try to channel these new energies into some creative pattern," Dims was saying, deathly weary. His face was a landscape of pain. The little psychiatrist had been working terribly hard. His bird-thin hands fluttered feebly as he talked.

"We've attempted to do this at all levels, restricted as we are by the conventions of government. These advertisements for the Agency of State were worked up by the Art Department, and will appear in many newspapers and trade journals across the country."

He lifted two new placards up onto the easel. I put on my thick old glasses, and stared at them. Their semantically arranged copy was hard to figure out; for a while they appeared to be the ravings of a lunatic. Then all at once they snapped into focus, and the brilliance

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of Dims and his co-workers became clear.

YOU CAN'T BE LOCKED UP FOR WHAT YOU'RE THINKING!

Peace depends on our ability to fight a war. Paradoxically, the only way to stay free is to study and learn and plan how to kill and destroy and murder. The better weapons you build, the more you contribute to freedom. So, knowing all about slaughter and destruction and murder and death, by devoting your life to thinking about killing and castrating and burning and hating, you make a great contribution to peace, love, freedom, and our way of life. It's convenient to regard preparation for hatred as an act of love, so you can kill and kiss and caress and set afire with burning gasoline and embrace and shove in a furnace and . . .

Dear scientist or engineer: If you would like to find yourself talking like this, and thinking like this, read no further. We are not for you. Otherwise, why not consider employment with the Agency of State. *We don't pay much, but we guarantee jobs in which you will never have to plan how to kill anybody.*

"A lot of the space research is for weapons, and a lot of the big space companies are weapons makers," said Dims in a tired voice. "This sort of stuff is very effective with them, especially so with the technical people. We're also planning to put it into the student journals—a very few student engineers consider themselves idealists.

"It has only limited appeal, however. Most engineering grads are very conservative. They're interested in security, safety, retirement benefits. For them we designed this one:

WHAT'S THE MATTER, ENGINEER?

Feel stuck in a rut?
Feel lost in the herd?
Feel pigeonholed, forgotten, exploited, abused?
Don't kid yourself!
That's not what's bothering you.
It's that you're tired of building Belsen and researching Ragnorak!

A recent study by psychologists showed that engineering is one of the most masculine professions. So if you're a tech tool, you're not afraid to get up on your hind legs and listen to some facts!

It's a fact: that 80% of all engineers are busy thinking up ways to commit genocide.

It's a fact: that spending five days a week, eight hours a day figuring out how to kill people can ruin your health—both physically and mentally.

It's a fact: that engineering companies don't like to say it, but they're basically in the business of finding new ways to make people die.

It's a fact: that you know this, and you know it down deep, and maybe it's bothering you.

Therefore, if you're a man—if you're a human being—you want to get out of Murder, Inc., for your

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own good, and for the good of humanity.

Therefore, we urge you to consider taking a position that deals with people, and tries to make people happy. Perhaps it will make you happy.

contact: The Agency of State
Underground, D.C.
Fortress America

Dims took down the placards. "These are only our first approaches" he murmured, "we'll have to check them against the norms of behavior in—" his face turned white suddenly, he sat down.

"Excuse me, Allan," he said in the shocked silence. "I'm not feeling very well. If I might be excused—"

"Certainly, Sidney," I told him, my head nodding stiffly. The old man limped out of the conference room, a bedraggled sparrow. I glanced at Manheimer, but his eyes were unreadable.

"If I might continue where Dr. Dims left off," said a red-headed fellow. His voice was high and nasal, but he moved with assurance. "My group has carried the campaign out along the orginal lines of development."

He stood, a hard, heavy man.

"Go on," I told him. My brain seemed to be on fire.

"Our group," he said slowly, "started on the original premise that scientists read escape literature because they are dissatisified. We concluded that scientists are unhappy with the 'team concept', of modern technology, the idea of a vast mass antheap surging blindly forward."

"The hatred of the team," he continued smoothly, "has reached its ultimate stage in the 'space team'. Most space scientists can't really believe this common goal baloney. They know their pleasure is vicarious, that when you get down to the countdown, that only one guy will ride the gantry crane elevator to that padded pressurized cabin just behind the nosecone. The rest of the 'team' will be sitting in front of their tv's, just like everybody else.

"This particular approach was used in the following piece;

COME ON NOW, SHEP!
WE'RE NOT KIDS ANYMORE

"There is only one word that most appropriately describes the group of scientists, engineers, and technicians that I have worked with on the Mercury program—they are a team."

—Alan B. Shepard,
America's first Astronaut

Come on Now, Shep!

You don't have to give us that! We know we're just dopey engineers and egg-head scientists. We know we're not good for much, otherwise why do you need thousands of us to build your crazy space rockets?

But at least show a little respect! At least say we did something by ourselves, each alone!

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Okay, you can have the glory. You can have the spreads in *Life*. But at least say the truth! We built your ship, we counted down for you, we hauled you out of the *ocean*, for God's sake! Give us *something*, even if we *are* a bunch of crazies and neurotics and robots.

Come on, Shep!

"There's a lot of hatred and self-hatred in this stuff," commented the red-headed man sullenly. "But what do you expect? There's plenty of it in any vicarious experience. Do you think the fellow that has to buy a sex magazine doesn't hate himself because he hasn't got a real lover? Do you think the student or engineer who reads S.F. does it without knowing that he's found his work in the sciences a tedious chore? Let's not kid ourselves."

The red-headed man paused, breathing hard. He looked around the conference room. Most of the staff was regarding him evenly. Somehow in my sight, the room seemed to swell and retreat, the cigarette smoke, the mahogony table, the beautiful Eurasian executive secretaries, the whisper of the air conditioners and the faint whiff of incense.

I was getting sick. I looked down at the impossible mathematics in my lap. It made no sense. All I could see were climbing curves, most of them projected straight up in a week or two.

"Of course," said the redhead. "This is only one level of the campaign. There're limericks, whisper campaigns, dirty jokes. Did I tell you why the astronaut cancelled his subscription to *Playboy*? I'll tell you after the meeting.

"A lot of the things the department is doing we don't even understand ourselves. They were programs outlined by the socio-mathematical computers at Seattle. Manipulating certain stocks, and arranging for a few government employees to be fired or transferred, or setting up our new aid program in southeast Asia. But the computers suggested these things would help to magnify the basic effect, so we're doing 'em.

"This brings us to our main problem, N.A.S.A.'s Project Leviathan," said redhead. "I'll let my associate from the advertising business explain the situation."

The copywriter stood again, his expression serious. The space agency has become aware of our efforts," he said slowly, "and is preparing a counterblow centered around the upcoming Project Leviathan launching. Our behavioral scientists have shown that this is crucial—if *Leviathan* doesn't come off NASA is probably finished."

Everyone around the table looked concerned. I did myself, though mostly from my headache. Everyone in the talk trades, I knew, soon acquires a good deal of stage technique.

"Think about the *names* of the spaceships for a moment," said the

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copywriter earnestly. "The PR people at NASA were very clever about them. The first ships had names like the *Liberty Bell* and *Freedom Seven* and *Motherhood* and *Chastity*. Who could criticize freedom or the Liberty Bell?

"The next stage was to give the craft names that appealed to our aspirations, our ideals of adventure; *Ranger* and *Pioneer, Scout* and *Apollo* and *Davy Crockett*.

"What the NASA boys have been doing is gradually manipulating these feelings and attitudes. First they made space flight synonymous with liberty and freedom and America, so objection was impossible. Now that most people approve of the rocket nuts, they're building an image that 'space is the only frontier left,' and space flight the only vaguely positive thing our civilization can accomplish.

"*Leviathan* is the third phase. Within thirty-six months the rocketeers have scheduled the completion of Project Leviathan, Project Gargantua, and Project Behemouth. Space flight will now be as basic as food production.

"This isn't sinister brainwashing and thought control, of course. But it has the same effect. At the end of the program you install a free floating idea in everyone's mind, like 'Negroes are equal to whites' or 'War is the fault of the munitions makers'. It's not that these ideas are true or false, it's that they're taken for granted.

"But the NASA boys aren't going to have it as easy as that. Here's what we've got planned for them. . . ."

Hours later I rose to my feet.

"All right," I said, my head throbbing. "According to the computer plots, the next month is when our operation is going to peak out for good or bad. This is when we wreck NASA and 'Murder, Inc.' for good, or they knock us off. We're fighting for the earth, people. Everyone has their instructions. I want you all to do your best." Everyone mumbled something. "Meeting is adjourned."

The staff shambled or ambled or gamboled towards the exits. Manheimer and his wife came up to me. I managed half a dozen more pills while my back was turned, then swung around to face them.

"What are you doing, Kadison?" he cried with wild eyes.

I listened to myself in my mind. Love, hate, danger, death. I wanted to use you, boy. Laugh and have a good time with your wife. Live true. Get out while you can. I don't know what's right anymore, I'm just trying to save something. The spacers will steal it all.

But I always insure myself, I remembered, from a long time before, what I was going to say to him.

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"It's obvious," I told him. "I'm trying to control space flight, kill it, at least for a good while. Don't you understand by now, haven't you been listening? It's ersatz, vicarious, filthy—what's more, it's killing us all with guilt. Ten million starve to death in Asia or South America so we can send a robot probe around Jupiter. Everyone knows it, way down deep, and it's driving us all nuts."

He was looking at me oddly. Let him.

"Well, maybe some of the things you say are so. I guess I should have thought more about the high, wide and deep. Trouble is, with my wife here"—and he smiled at her.

"Sure, you don't have to settle for ersatz, you've got real meat now! Live true, kid—get out before you choke on the sawdust!"

He blushed furiously but his petite wife was calm. "You're cured, son, but you're no good to me now," I mumbled. Why did everything have to move so *fast*? I tried to hold things still. Looking at him, still big and tough, but happier now. Building a ship to scout Mercury, while his parents were slaughtered in Asia for their meat. It'd be enough to tip the stablest mind. He was just lucky he hadn't gotten violent and been machine-gunned down by a security guard.

"Listen, sonny," I told him in a rapid, slurring monotone. "You're re-assigned. To the new Asian Aid program. Going out on the next ramship with your wife. Oh, yeah, boost you three grades. Very good job you've done for me here."

"Kadison?" he said slowly, the Texas burr fading out and in. His face looked funny in the fluro-units.

My body hurt. I had to stand up straight. My roommates were always telling me to stand up straight, back at M.I.T.

"No time," I said. "Get out fast. Ever read John Hersey—'The best defense may be departure'—best for you. Ha! Worst for them. Space flyers hate the earth, that's why they want to get away from it so bad. Can't stand it. Space flight final sign of rotten, decaying culture."

He was looking at me funny again, and his eyes moved towards the communicator. "Go *on*! Get *out*!" I screamed at him.

"All right, Kadison," he told me. He took his pretty young wife around the waist, and the two of them left.

I made it back to my office.

If we aquiesce in all things,
Do not be deceived;
It is because we despise you.

—*Anonymous*

III

Do or die, or do or die. *Leviathan* was two hours from zero.

Phone and power service were

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out, but the Agency of State had its own thermonuclear reactor. Events had been moving faster and faster, three NASA chiefs had been appointed and had resigned within the last week. Anti-space flight mail to Congress and the president was up enormously—what most people don't know is that most of the mail a public servant receives is from his supporters, but tens of thousands of angry citizens were "making their voices heard."

Our campaigns had proved fantastically effective. As things stood, the NASA budget was unlikely to be ratified, if the agency itself was not dissolved. I ran my hand over the reports: College students, with placards like *"You Build rockets! People are starving! Are you crazy!"* had picketed the Richard Jastrow Space Flight Center at Harvard. Thousands of recruits for the Peace Corps and the Agency of State had stormed our offices. We'd given them an absolute minimum of training and sent them out on all the ramjets we could requisition from the Defense Branch of the government. There were strikes at Vandenberg AFB, and a student trainee had sabatoged the Sandia fusion reactor.

I glanced at my watch. An hour and forty-five minutes until *Leviathan* fired.

There was a pattern to this, but I didn't know it and didn't want to figure it out. I was all right as long as I just reacted to things. Events had become meaningless and random, as enigmatic as the plots and tables of the latest sociomathematics from Seattle. Most of the curves pointed straight up.

I was collapsed in the relaxer in my own office. Dirty, sweaty, unshaven, I must have shaken the Commissioner of State, though his formal diplomatic training had been too good to let my frenzy disturb him.

"Are you criticizing me for succeeding?" I cried at him. If I ever had any savoire-faire I'd certainly lost it; at the moment I doubted if I had bus fare. "We both agreed that this was necessary. Would rather have had the science worshippers close us out completely, or the Defense Branch talk the President into a pre-emptive strike?"

I took a deep breath. "—Or even if they didn't, sooner or later the poor starving whipped beggars on the other side of the globe would've attacked. We've got to realize that we're on the side of life, and the 'hot-jets' boys want to burn the earth sterile and start over."

I put down the latest reports. Red-headed Millhouse (he'd taken over when Dims had been hospitalized), was setting up a massive campaign against "spin off." He had definite, conclusive proof that the only useful byproduct of the space flight program in the last five years was a new kind of brassiere,

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an application of weaving plastics for fuel tanks.

"Billions for the moon, because the work will have byproducts for medical research? Why not billions for medical research—it's just as likely to have byproducts for space flight!" the first ad read. It was a swell notion, but a waste. According to the sociomath, space flight would be settled one way or the other, in the next hour and a half.

I switched on the television set. A picture built up on the screen, three dimensions and color, beamed down from the spinning wheel of orbital relays. The trademark of the space communications monopoly burned before me, a climbing rocket, burnished and spouting flame. Any psychologist could've instantly explained the symbolism.

The space agency was preparing a (I flattered myself) desperate psychological counterblow. They were putting everything on a single grandstand play, the launching of their biggest ship, the *Leviathan*. The countdown had been featured in the news for weeks as the beginning of regular, economically feasible space travel.

"The regularity is the critical phrase," the adman had told the conference. "I don't know how much you know about sociomath but it's a basic principle of elementary sociology that once an institution gets regularized into the social structure, accepted, normal—it's nearly impossible to destroy. The text example is an old law which says you've got to mail a notice of benefit cancellation to people who die on Social Security. It took fifty years to get that one off the books.

"While space flight is a freaky experiment we can knock it off. Once everyone takes it in stride—"

"And now," said the announcer, "we take you to Cape Kennedy Spaceport, where the countdown is proceeding on Project Leviathan. Take it away, Leviathan Control!"

I could hear the chiding, subtle tones of one of NASA's best propagandists as the cameras panned around the blockhouse. "Waiting for fulfillment," he murmured erotically, "here, where the work of the great teams of manpower and brainpower is about to be consummated. The lust for adventure, the passion for discovery, the burning, driving ecstasy of science! Yes, space flight is the destiny of every true man!"

"Minus one hour," someone said flatly.

I scratched my armpit as the cameras shifted around. The dozens of technicians and engineers, their heads crammed into headphones, most of them in teeshirts or sportshirts, smoking or muttering to each other in low tones. Winking lights, flipping, flickering indicators. A tremendous plastic plotting board, with "Project

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Leviathan Control—National Astronautics and Space Administration" spelled out on it. I looked at the faces.

I was looking for signs.

We were not going to use violence unless we had to. Our first line was still psychological, and during the previous three weeks we had pumped enough psychic energy into Cape Kennedy and the surrounding area to make that blockhouse a gigantic psychological time-bomb.

Our ads in magazines and newspapers and on the mass media, the student demonstrations and protests, were only part of it. Space flight had been denounced as unpatriotic and contrary to the interests of the United States by the American Civil Liberties Union, and the A.A.A.S. Several western schools had revoked the degrees of engineers and scientists at the Cape. SANE and the Mothers March for Peace had taken stands against the rocket men. Even a few industries that used computers and transistors had boycotted those firms which served the spacemen.

I recalled the picture of an emaciated child in one of our efforts. Just his picture, a full page among the fiery phalluses of *Missiles & Spaceships Magazine* . . .

A tremendous clock with one red hand was unwinding slowly. Engineer, scientist, craftsman—each of their hundreds of talents mixed and blended in an enormous technology that rumbled blindly forward and up—a vehicle for the hates and horrors and fears and guilts that towered against the sky. Hate your mother, cheat your brother, afraid of girls—don't worry, as long as you design a good nosecone, you're a wonderful guy!

"Thirty minutes," someone murmured tensely.

Like an army, like a mob, like a firing squad—great organizations let the individual submerge himself; allowed him to displace his fears by blowing the buoyancy tanks of his hopes.

"Our *Leviathan* astronauts—" cried NASA's voice, "in the final moments of countdown!"

Shot of chaos, gleaming silver and sweating faces, control panels, then your mind straightened out the picture and you could see it was the big ship's control cabin, the astronauts in their silvered suits, blond, red-headed, smiling handsome young fellows. Propaganda tricks! Illusions for public consumption! The Chosen for Whom We All Must Labor.

"Minus fifteen minutes, standby holding—"

"Re-commence countdown, *Leviathan,*" said a voice. "Orbital stations report flight plan clear and ready to track you."

That explained it. The space agency was using all the facilities it had under its own control. This television appeal itself would've

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probably been impossible except that NASA controlled the satellite relays. They'd stopped all Agency of State propaganda, but we didn't have to convince anyone outside Fortress America.

"Minus ten minues, *Leviathan.*"

Manheimer and his wife were somewhere in the western Pacific. He'd written me she was ill, but he knew enough of my feelings to also boast of his work on a dam project on one of the islands. Honest work, an honest life; he'd be okay. No longer a crazy pyramid builder.

"Nine minutes, *Leviathan!* Counting!"

I looked around the blockhouse. Did some of the men have strange, pained expressions? But that could just be from the ordinary tension, as the shoot neared its final minutes. The next couple of moments would decide if our psychologists and psychometricians had judged correctly.

Psychologists and psychometricians. People-scientists, earth scientists.

"Six minutes, *Leviathan.*"

Leviathan stood alone on her pad, a monstrous thing, all gleaming metal, burnished and painted. The culmination of the labor of millions, who could derive only the most indirect pleasure from it. A pyramid, a carved mountain, a great church mortared with human blood, a monument to men's guilt and self-hatred. This *proves* we are worthy!

I thought of the die-hard space enthusiasts who would curse us for what we were doing to this proud thing. *We don't hate it because it is a phallus.* I thought. *We hate it because it's the only one we were allowed.*

"Two minutes, *Leviathan!*"

Far away a tremendous crowd; unnecessary personnel, wives and families, sight-seers, waited in silence. The cameras swung back to the big rocket, crowd again, Leviathan Control. I strained my eyes. Did a cheek twitch, a pair of hands shake over their console? The ship again, as the countdown unwound through the final seconds.

"Three, two, one, zero, ignition, lift off!"

A snort of fire, a cloud of vapour, a tremendous roar that blanked out everything for a moment. Fire torched out of *Leviathan,* and she climbed for the sky.

The pickups switched back to Project Leviathan Control. There were a few cheers in the blockhouse, but they sounded odd. The engineers studied their instruments and peered through periscopes. A few closed their eyes.

It's got to happen now! I strained to myself.

Mark twenty, twenty-four, twenty-eight," someone was chanting loudly somewhere. A klaxon hooted, and a dozen started wildly. Some of the faces were drawn. A lot more seemed politely uncaring.

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"Goofed, I goo—propulsion system failure!" wailed someone in the interphone. "Correct or activate alternate system!"

"Why bother?" came another voice anonymously. "Scrap this."

Two people began laughing hysterically.

"Interphone discipline, interphone discipline!"

"Abort you!"

"Eject module gamma-six of solid-propellent—standby to re-ignite!"

"Get someone else to do it!"

"Leave me alone, leave me alone, help, help, help!"

"Those guys are right—spend the money on parks and fun—I haven't had a good time since my Sophomore—"

"This is *Leviathan!* Do something, do something, do anything!"

Help yourself, *teammate*—I didn't get any of that *Life* money!"

"Standby to destruct!" rumbled a Brooklyn voice. "Eject, heros!"

"Destruct, destruct, blow 'em to hell, the rotten crooks!"

"Yeah, they stole our money, they stole our good times! Kill 'em!"

"Help, leave me alone, help, leave me alone, help—"

"A-okay, what's a-okay? I just keep pushing this button and they fly away. I'll drop dead some day and they'll get someone else to push the button!"

"Blow 'em up! 'Destruct 'em, the rotten snobs, Earth ain't good enough for 'em!"

"With pleasure!" cried the Destruct Officer. "I'd like to blow up five million of these space nuts! Call us ground crawlers! I'll fix *you* guys!" he screamed.

The television screen, which had gone blank, closeupped a big hairy hand grabbing a big fat red handle labeled 'DESTRUCT!"

From all over the room, and the observation post along the shore came screams; "Crash, baby, crash!" "Make it crash!" "Destruct them!" "Crash, crash, crash, crash!"

"We thought you guys were all part of the team!" cried the voice from out of the sky. The last words disappeared in a clot of static.

The static also covered the reply

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of the Destruct Officer. But as a capable lip reader, let me state it was two words of one syllable each.

The camera men worked fast. The picture changed to the climbing *Leviathan,* a midge against the blue, pulsing, shrieking, going up. Telephoto lenses closed the distance.

The explosive charges let go in quick succession. The space rocket *Leviathan* climbed and climbed and climbed away, then her venturies seemed to expand until she was trailing a great cone of fire. She was still brilliant in the sunlight, golden and pure and straight and true as she went up and up and up and up and up, unmanned now, but there was more fire and more and more. A double cone of brightness, silver and gold, and she climbed and something fell away, and some more. But she was still beautiful. And she was swinging over and a little more and more, parallel with the ground and sea, racing above earth, plunging onward, and then she dropped and the *Leviathan* exploded like a big fat rotten banana, trailing, scattering, drifting, gone, clouds and vapor trails all that were left. Not very far away, her passenger capsule was drifting down towards the heaving sea under a dome of red and white canvas. Copters reved and slid up and out after it.

On the screen, the last traces of vapour faded and then disappeared.

My stomach felt the fiery grip of an ulcer, and I sobbed as I reached forward and turned the set off. Would it work? I'd won—but what had I won? A migrain lanced my skull. I clung for a moment to my hopes. There could be a compromise worked out eventually, a give and take. There were those who might naturally want the stars—I remembered a night long ago, lying on my back and staring at their faint pricks of color; *how long had I suppressed that memory?* Where, how long ago, had it begun? Earlier than my Peace Corps days, then? I put my shaking hands to my head. It was over now; finished. I passed out.

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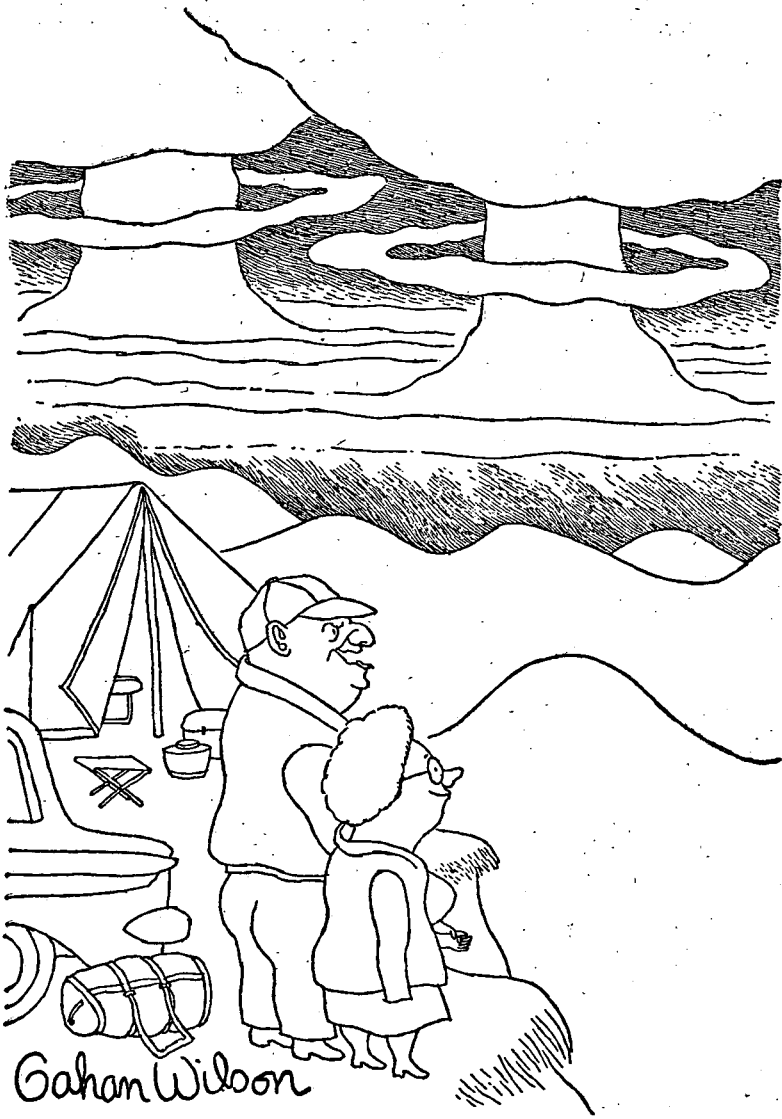

"Boy—you talk about your lucky timing!"

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Mr. Young has had his distinctive stories collected in the recently published THE WORLDS OF ROBERT F. YOUNG (Simon and Schuster). His newest story for us is this surprising and charming account of the Past Reconstruction Corps, and of PRCman 3rd class, Archer Frend.

ROMANCE IN AN ELEVENTH-CENTURY RECHARGING STATION

by Robert F. Young

ARCHER FREND WAS FAR FROM being an old hand at time-traveling, but he wasn't exactly a novice at it either. As a result when the gray trans-era void through which his time-suit was propelling him started to flicker when he still had some fifteen centuries to go, he was both alarmed and unafraid —alarmed because he had never "run out of gas" before, and unafraid because he knew that the electronic station-index with which his suit was equipped would automatically shunt him to the nearest recharging station before the last of the energy in the suit's Contra-Hour-&-Age-Power-Pac gave out.

Ordinarily, the CHAPP would have been bursting with energy, but Archer had just spent three trying months correlating events in a place-time classified by the Past Reconstruction Corps as "The Age of Gaul", and he had been in such a hurry to leave that he had neglected to recharge the unit before setting out. The PRC, he knew, would not let such an oversight go unpunished, and he could count on being called on the carpet mere moments after his arrival in the twenty-sixth century; and as there was a distinct possibility of his losing his hard-won rating of PRCman, 3rd class, he was not only alarmed and unafraid —he was unhappy, too.

The flickering slowed as his momentum decreased, and scrambled sequences of land and sky began to materialize, alternated by splotches of blacknesses scarred by stars. The transition was all the more disquieting in this case be-

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cause it involved spatial as well as temporal orientation, the one necessitated by the sideways drift set up by the electronic station-index and the other by the slowing-down process brought about by the dwindling of the contra-hour-&-age energy. It was anything but a pleasant experience, and it would have disconcerted a veteran; Archer, who, as before stated, was not one, felt like kissing the ground of the little forest-clearing that the flutterings of nights and days and the crawlings of scrambled sky and landscape at last gave way to.

The clearing was a good-sized one, and it was prodigally puddled with early-morning sunshine. The luxuriance of the grass and the pale greenness of the leaves of the encompassing trees revealed the season to be spring, and a chill, but far from cold, morning wind laden with the fragrance of wild flowers emphasized the wondrous fact. Birdsong was everywhere, and the singers themselves were daubs and streaks of color among the trees and against the blue unclouded sky. Before becoming a PRC field-worker, Archer had never seen a bird, and he still hadn't gotten over them. Not that there wasn't any in the twenty-sixth century; it was just that what few there were knew enough to keep clear of people, and did. It was said that the Great Lakes swamp was full of them, but Archer had never been to the Great Lakes swamp, so he didn't know.

The twenty-sixth century was sort of a gray world when you came to think of it. Living in it, you weren't aware of the grayness; but when you got to know a few green worlds you couldn't help but notice the difference. The twenty-sixth century was a city, really—a vast sprawling affair built upon the ruins that had survived the Interregnum. Acreages had been set aside for farms, of course, but somehow the farms never seemed to get very green—not even in summer. Something had gone out of the soil, the experts said. Or something had gotten into it. No one knew quite what, though, and probably no one ever would.

This green world was about the loveliest that Archer had ever seen.

He sort of wished he didn't have to leave it.

The wish scared him, and he brought himself to time in a hurry. This was no way for a PRC-man, 3rd class, to be behaving. Instead of daydreaming, he should be bending his every effort toward getting back to the world where he belonged so he could turn in his report and thereby enable it to be incorporated with the rest of the data thus far accumulated by modern mankind in their attempt to fill the hiatuses of recorded history. Ashamed of his apostasy, he activated the Frimpkin-counter,

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which was also part of the equipment of his time-suit, and began turning slowly around. . . .

The purpose of the instrument was to detect and count the energy activity-rate of the Contra-Hour-&-Age Recharging Magneto and by the frequency of the clicks enable the user to home in on the station proper where the CHARM was hidden. In the present instance, the clicks came most rapidly when Archer faced east, but they didn't come as rapidly as they should have, and this puzzled him. However, the important thing was that the CHARM was in the immediate vicinity (the range of the counter was less than two miles) and could be located within an hour or so. Shelving the mystery of its less-than-normal activity-rate, he set out in search of it.

He hadn't gone far before he came to a narrow dirt road. It was deeply rutted and abounded in mud holes, but as it led in an easterly direction he decided to follow it. Presently he saw a team of oxen approaching. The yoked beasts were drawing a crude four-wheeled cart loaded with tinderwood, and on the driver's seat sat a middle-aged man wearing a baggy blue suit and a kerchief-like hat. Archer, however, made not the slightest attempt to conceal himself. There was no reason for him to, for in addition to its regular chores a time-suit "dressed" the wearer in clothing appropriate to whatever age he happened to be visiting. It accomplished this by means of an illusion-field that forced the "viewer" to provide the "clothing" himself. If the viewer's emotional state and predilections were such that the "clothing" was unfavorable to the wearer's welfare, the illusion-field made whatever alterations that were necessary. In the present instance, while Archer had no way of knowing the true nature of his "new clothes", the awed expression on the cart-driver's face as the awkward vehicle lurched by informed him that they were nothing to be ashamed of.

A few minutes later he passed an old woman carrying a bundle of twigs. Her awed expression and obsequious manner indicated that her taste in "clothes" coincided with the cart-driver's.

Not long afterward, looking over his shoulder, he saw that the old woman was following him. The cart-driver had turned his cart around and was also following him. Presently Archer passed a small roadside cottage, and a few moments later a young man and a young woman and three children fell in behind him. A second roadside cottage swelled the ranks of his retinue by six more souls, and a fourth, by eight. Judging from the awed expressions on the followers' faces, he was regarded as something of a celebrity.

But that was all right. The na-

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tives were welcome to see him any way they wanted to, so long as they didn't interfere with his search.

The road continued on a reasonably straight course, and at length it emerged from the forest. To his left fields stretched away to distant hills, and on his right a high hedge rose up, hiding whatever lay beyond it. By this time his retinue numbered some thirty-five persons, and it was obvious from the way they were jabbering to one another and waving their arms that they were firmly convinced that something of great pith and moment was about to take place.

Archer felt sorry for them in a way. He hated to disappoint people.

The hedge remained unbroken for several hundred yards; then it interrupted itself briefly and gave way to a lofty gate. The frequency of the Frimpkin-counter clicks pointed an invisible finger toward the opening, and, certain that the CHARM was located somewhere beyond the hedge, he turned off the road—to the accompaniment of an awed gasp from his retinue—and walked boldly up to the gate.

It was unguarded, and consisted of a pair of ponderous iron grilles, many of whose bars had completely rusted away. Through the interstices he saw a vast expanse of green and disciplined grass, and a distant quartet of exotic buildings. A flagstone path followed an anfractuous course from the gate to the largest of the structures, winding among little islands of flowers and green exclamation points of flower-like trees. Heat waves, not at all in keeping with the time of year, seemed to be rising from the ground, and buildings, grass, trees, and flowers had a strange indistinctness about them—an unreal aspect that disconcerted Archer almost as much as did the realization that in the land beyond the hedge spring had come and gone some time ago, and midsummer was on hand.

He stepped through one of the gaps in the gate—again to the accompaniment of an awed gasp from his retinue—and started walking along the flagstone walk. Several steps later he felt a faint tug, and a moment afterward the shimmering effect which he had noted a moment ago disappeared. The early-morning wind was no more, and the heat of midsummer was all around him.

What strange world was this that could maintain two different seasons side by side? Archer, in his role as a PRCman, had run across many a marvel, but he had never run across one like this.

He continued walking along the flagstone path, looking this way and that for some sign of life. He saw none whatsoever. Not only was the estate devoid of human-life, it was devoid of animal-life, too—or at least it appeared to be.

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There weren't even any birds, or if there were he could not see them; and not so much as a single dog came forth to remind him either by bite or bark that he was a trespasser.

He glanced over his shoulder. His retinue now numbered in the fifties or the sixties, but it could no longer properly be called a retinue, for its members, having come as far as the gate, apparently had no intention of proceeding beyond it. Clearly, they were going to watch the show from where they stood.

What sort of a show did they expect to see?

As he drew closer to the largest building, the clicks of the Frimpkin-counter stepped up their tempo—a clear indication that the CHARM was located either in the building itself or just beyond it. But considering the closeness of the station the frequency still wasn't what it should have been, and a vague uneasiness beset him. To counteract it, he focused his attention on the building. It was in excellent condition, but with its gray stone walls and high narrow windows it was almost as oppressive as it was impressive. Large, pointed knobs, slitted with windows, rose up from its roof, and atop these knobs were other knobs—tiny ones that looked for all the world like fat decapitated birds. Atop the largest of the knobs proper was a slender pole, and attached to it and drooping in the windless air was an orange and purple banner.

Two of the three smaller structures were similar to the first, and were connected to it by what appeared to be enclosed walkways. The fourth was located behind the others, and most of it was hidden from Archer's sight; but he could see enough of it to ascertain that it was constructed of wood, rather than of stone, and that it was far less prepossessing than its brothers and sisters.

The flagstone path ended at the base of a set of stone steps that led up to an imposing portal. As he drew nearer, Archer saw that he had been wrong in concluding that the estate was deserted, for on either side of the portal stood a guard dressed in multicolored clothing and armed with a lance.

Boldly, Archer ascended the steps, confident that the two men would "clothe" him in pretty much the same fashion as the other natives had. But the guards, much less than "clothing" him, didn't even appear to see him. They were staring straight ahead and standing as stiffly as two sticks of wood. Moreover, neither of them was breathing.

Archer's first thought was that they were dead. Then he saw how ruddy their complexions were, and discerned an awareness of sorts in their eyes. He touched one of them on the cheek. The man's face was as warm as it was rosy.

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No, the guards weren't dead—at least not in the ordinary sense of the word. In some mysterious fashion, they were alive.

Archer shrugged, and transferred his attention to the portal. The mystery wasn't in his province—it was in the province of the CHARMman who had established the station. No doubt it had already been reported, unless of course it hadn't existed when the CHARM had been hidden. "When", however, presented still another mystery. The PRC, in order to facilitate recharging and to insure the safety of its personnel, had established stations at temporal intervals of 500 years and (except where large bodies of water interfered) at spatial intervals of 500 miles; but although chronology was computed on an A.D.-B.C. basis and was simple enough to follow, unless you were capable of supplementing your time-suit's electronic station index with an eidetic spatio-temporal map showing the locations of the stations, there was no way for you to ascertain how long any one of them had been in existence. Thus, while Archer knew approximately when and where he was, he had no idea whether the station had been established yesterday or 500 years ago.

The portal was ajar. He pushed it the rest of the way open and stepped across the threshold. Finding himself in a deserted high-ceilinged corridor, he walked down it to an arched doorway that gave into an enormous room that rose almost to the roof. At the farther end, a richly caparisoned couple sat on a huge, thickly upholstered couch, and throughout the room other people either sat on other, less imposing, couches, or stood in various attitudes. Some of them seemed to be frozen in the midst of taking a step, but none of them—either sitters, standers, or walkers—moved so much as a single muscle or made so much as the slightest sound. They were no less dead than the two guards—and no less alive, either.

A gallery ran the gamut of the room at a height of about twenty feet above the floor, and a flight of stone steps led up to it. Beneath the gallery, at the rear of the room, a second arched doorway gave access to another room. Stepping inside for a look around, Archer found himself confronted with an even more curious tableau than the one he had left behind him. The room was clearly a kitchen, although it bore only the remotest resemblance to its twenty-sixth century counterparts. In the background, there was a primitive iron stove, and upon its grid lay a large cut of meat. Beneath the grid the red flames of a wood fire were discernible, but unlike conventional flames they were immobile. Beside the stove sat a young girl who was holding a feather in each hand and

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cradling a plump, beheaded bird on her lap. In the foreground stood a husky woman, and cowering before her was a small boy. The woman's right hand was raised as though she had been about to deliver a blow before she, the boy, and the girl had been transformed, along with everyone else in the vicinity, into living statues.

Archer walked across the room to a window at the back and looked into a large yard. Here and there, plump birds like the one the girl had on her lap were standing in this attitude and that; but although they still had their heads they were making no sound, and they were no more active than their beheaded companion was. Not far away stood the wooden building Archer had caught only glimpses of before, and in front of it, as immobile as the tableau in the kitchen, stood six horses, two cows, and a goat. Just beneath the window three big dogs were lying, but whether they were sleeping or dead or neither, he could not tell from his present position, and saw no point in drawing the distinction in any case.

Retracing his steps to the first room, he started up the flight of stone steps that led to the gallery. Promptly, the clicks of the Frimpkin-counter increased in frequency, and by the time he reached the gallery they sounded comparatively healthy at least, although nowhere near as healthy as they should have sounded. The gallery was lined with doors, most of them closed; but he paid no attention to them as he passed, bestowing all of his attention on the clicks. The clicks remained fairly constant till he came to the thirteenth door; then they kicked up a modest storm, and he knew he was reasonably close to his objective.

The door opened upon a narrow hallway. He thought at first that the hallway itself was the station, for it was more or less typical of the sort of location CHARM-men, who proceeded on the principle that the best hiding place was the most obvious one, usually chose for stations. It was part of a building that under normal circumstances functioned as a center of activity, and yet, judging from the dust on its floor and the cobwebs hanging from its ceiling, it was no longer in use and hadn't been for some time, a fact that made it doubly ideal. However, it didn't turn out to be the station after all, and after proceeding a score of steps he came to a narrow flight of stone stairs that wound upward into gloom and more cobwebs.

He thought the stairs would never come to an end, but finally they did—at the base of a little door. It was ajar, and he needed merely to push it the rest of the way open to gain entry to the chamber beyond. As he did so, a small key fell out of the rusted

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lock and clattered down the stone stairs. Aside from his own breathing, it was the first sound he had heard since leaving his erstwhile retinue behind him.

The chamber into which he now stepped was quite small, and he judged it to be the interior of one of the "knobs" he had noticed on the building's roof. In the way of furniture it contained precisely two items: a bed that stood beneath the only window, and a small machine that stood in one of the dusty corners.

It was as quaint a machine as Archer had ever seen, and consisted of a wooden wheel mounted upon a three-legged wooden frame. Above the wheel, and attached to a small wooden arm, was the object of his search.

Now he could resume his journey to the twenty-sixth century and leave this enchanting green world behind him.

Stepping forward, he detached the CHARM and clamped it onto the Contra-Hour-&-Age-Power-Pac, which was located just above the left breast-pocket of his time-suit. The energy-release activator was hidden in the base of the CHARM, and after finding the tiny protuberance he attempted to depress it—

Only to discover that it had already been depressed.

Stunned, he held the CHARM against the Frimpkin-counter. The latter erupted into a series of wild clicks, then settled back to its lackadaisical self.

He performed a few arithmetical calisthenics. He would have performed them before if he had guessed the truth. The result staggered him: at best, the CHARM had enough contra-hour-&-age energy left in it to take him to the beginning of the thirteenth century.

But that meant that the device had been activated at least a hundred years ago!

And throughout those hundred years it had been pouring out contra-hour-&-age energy at a rate of at least 400 Frimpkins a day. Enough to isolate a small city—

Or a large estate . . .

No wonder none of the people or animals he had seen since he had come through the gate had breathed or moved! The entire estate had been banished from the time stream.

The reason he hadn't been affected was that he had come from beyond the field which the escaping contra-hour-&-age energy had established. He was an outsider, and did not belong in this tiny capsule of reality.

He looked at the CHARM closely. The activator was cleverly hidden, and the odds against someone finding it by accident were a thousand to one; but such odds were not insuperable, and it had been inevitable all along that someone —sometime, somewhere—would

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innocently create a field such as this one.

He deactivated the spindle-shaped device.

Who had activated it?

He looked around the room. For the first time, he noticed that there was someone lying on the bed.

A girl.

He went over and gazed down at her.

She had a heart-shaped face, and her hair seemed to have been spun of summer sunlight. He judged her to be about eighteen years old.

Apparently, after accidentally activating the CHARM, she had lain down and fallen asleep before time had come to a stop.

As he looked at her, she stirred, and began to breathe, and he knew that the contra-hour-&-age field was beginning to disperse.

His lonely years gathered around him like gray ghosts, and climbed upon his shoulders.

He bent down and gave the girl a kiss and drove the many years away.

She sighed . . . and opened her eyes.

They were blue.

Why, it was like a fairy tale, almost.

The midsummer heat gave way, and a spring breeze blew through the window. He looked out across the trees and the flowers and the green grass to the gate. There were about a hundred people standing beyond it now, and they had seen him in the window and were waving their arms and jumping up and down.

Probably the old wives and the old husbands among them were already making the fairy tale up.

He looked down at the girl again. She looked back up at him. Once more, his time-suit did handsomely by him, and it was clear from the expression on her face that she thought she was seeing a rich man—

Or maybe even a prince.

He could probably learn her language and the ways and customs of her day and age in no time at all. It promised to be fun. He bent down and kissed her again, just for good measure . . . *And the horses in the courtyard shook themselves; the hounds jumped up and wagged their tails; the pigeons on the roof pulled out their heads from under their wings, looked round, and flew into the open country; the flies on the wall crept again; the fire in the kitchen burned up and flickered and cooked the meat; and the cook gave the boy a box on the ear, and the maid plucked the fowl ready for the spit . . . And in due course the marriage of the "King's son" with Briarrose was celebrated with all splendor, and they lived contentedly to the end of their days.* ◀

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Few of us can really bring ourselves to be sorry about the sad fate of the sabre-tooth tiger or the extinction of the baluchitherium. The wooly rhinoceros has few friends. But somehow, for some reason unknown and undefined, most of us do have an almost nostalgic attachment to the memory of the mammoth and the mastodon. They probably had vile tempers, smelt bad, tasted gamy, and doubtless never ate a peanut in their lives. But still . . . And yet . . . Here is our Stalwart Savant back from Bamangwatoland—or is it the Matto Grosso?—and all ready to tell us as much about the subject as most of us are capable of knowing.

MAMMOTHS AND MASTODONS

by L. Sprague de Camp

EVERYBODY KNOWS THAT MAMmoths and mastodons are large, hairy relatives of the elephant, which lived long ago. They are standard props of stories laid in primaeval ages or in a land where prehistoric animals have survived to modern times. In Cutcliffe Hyne's *The Lost Continent* (1900) the Atlantean empress Phorenice rides a tame mammoth. In E. R. Burroughs' *Out of Time's Abyss*, modern men exploring an imaginary continent come upon "an enormous dragon devouring the carcass of a mammoth." In J. R. R. Tolkien's *The Two Towers*, "the Mûmak of Harad was indeed a beast of vast bulk, and the like of him does not walk now in Middle-earth; his kin that live still in latter days are but memories of his girth and majesty. On he came . . . his great legs like trees, enormous sail-like ears spread out, long snout upraised like a serpent about to strike . . ."*

But wouldn't you like to know a little more about these animals? How many kinds were there? Were they larger than modern elephants? How big did the largest get? Which did early men encounter?

Before we can say whether mammoths and mastodons were bigger than modern elephants, we

*Out of Time's Abyss, *N.Y.:1963, p. 19;* The Two Towers, *Lon.: 1955, pp. 269f.*

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should know something of the size of modern elephants. Of the dozens of species of the order Proboscidea [1] that have flourished during the last few million years, only two now exist. These are the Indian or Asiatic elephant, *Elephas indicus,*[2] of India and southeast Asia; and the African elephant, *Loxodonta africana,* of Africa south of the Sahara.

The main differences between the two are as follows: the African elephant is larger, taller, and of rangier build. The African elephant has much larger ears than the Indian. (In one Tarzan movie, Indian elephants were fitted with false ears to make them look African.) In the African elephant both sexes have tusks, although the male's are stouter; in the Indian, the female has rudimentary tusks or none. The African elephant's forehead makes a smooth convex curve, while the Indian's rises to a pair of bumps or domes. The African elephant's back dips between shoulders and haunch, while the Indian's back is convex. There are also differences in the teeth, trunks, toenails, and so forth.

Each species is divided into several races, subspecies, or varieties. The most distinctive races are the Ceylonese race of the Indian elephant and the forest race of the African. The Ceylonese elephant, *Elephas indicus ceylanicus,* is large as Indian elephants go, but nine-tenths of the males are tuskless. The forest elephant, *Loxodonta africana cyclotis,* of the Congo basin and the West African rain forest, is rather small—about the size of an average Indian elephant—with long, slender tusks.

The ranges of both species have greatly shrunk during historic times. A large race of the Indian elephant dwelt in eastern Syria down to the ninth century B.C., and a small race of the African elephant ranged the valleys of the Atlas Mountains, in Algeria and Morocco, down to the fifth century C.E.

The size of elephants is not easy to settle, because elephants are hard to weigh and measure. Moreover, elephants vary in build. Which is the larger, a tall, lean elephant or a short, stocky one that weighs more? And how about the sexual difference, since the males of each species are much larger than the females?

The commonest measure is the height of the elephant's back at the shoulder. The top of the elephant's head is usually higher, but the elephant moves its head about too freely to make this a trustworthy measurement. Many supposed record elephants have been wild ones, reported by the men who shot them. But you cannot measure a live wild elephant; and the

[1] *Pronounced pro-ba-SID-ee-a.*
[2] *Some classifiers prefer the name* Elephas maximus.

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shoulder height of a dead one, even if the hunter is not exaggerating for the sake of glory, may differ from the height of the animal in life.

The only group of weighed and measured living elephants numerous enough to give a good idea of minimum, maximum, and average dimensions are fifty-two adult Indian female zoo and circus elephants measured by Francis G. Benedict in the 1930s.[3] They ranged in shoulder height from 6 feet 7 inches to 8 feet, with an average of 7 feet 6 inches. They weighed from 1.9 to 4.6 tons, with an average of 3.2 tons. Because of differences in build, the tallest elephants were not always the heaviest. Nevertheless, if you plot the weights against the heights of elephants of all ages, both sexes, and both species, they fall fairly close to the $y = ax^3$ curve, where y is weight, a a constant, and x shoulder height.

Similar figures are not to be had for male Indians or for Africans of either sex. From what various writers say, we can guess that Indian males and African females are of about the same size, with an average shoulder height between 8 feet 6 inches and 9 feet, and a weight between 4 and 6 tons. The corresponding figures for the adult male of the East African bush elephant (the largest race) are: average shoulder height, between 10 and 11 feet; average weight, between 5 and 7 tons.

As for the greatest sizes, the record height for an Indian male is 10 feet 8 inches. Tusko, an Indian bull elephant famous for his size in the 1920s and 30s, stood 10 feet 2 inches and weighed a little over 7 tons. The famous Jumbo, an African male, stood 11 feet 2 inches (at least, that is one of the several heights given in the literature) and weighed about 8 tons. Khartoum, of the Bronx Zoological Park, stood 10 feet 8.5 inches and weighed 5 tons. An African elephant mounted in a British collection is said to stand 12 feet 6 inches.

During the past century, sportsmen have reported killing many African elephants over 11 feet tall and of seeing elephants over 12 feet. Scientists were long skeptical about these reports. Then, in 1955, J. J. Fénkovi of Madrid killed a bull in Angola. When mounted, this elephant was 13 feet 2 inches tall. Its live weight is estimated at 12 tons. It stands today in the rotunda of the National Museum of Natural History in Washington. This elephant not only surpasses all other known living elephants, but is also in a class with the largest fossil proboscideans.

Fossil elephants have been

[3] *Benedict also measured a single male Indian and ten young (under 20) females, but I omit these so as not to spoil the homogeneity of my sample.*

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known since ancient times, although not until recent centuries have they been recognized for what they were. They were usually described as the remains of giants, since the skull of an elephant does look a little like the skull of a peculiarly unpleasant-looking human giant. In medieval Europe, fossil elephants' tusks were called unicorns' horns or gryphons' claws.

In the seventeenth and eighteenth centuries, fossil tusks began to reach Europe from Siberia. Those who brought them said they came from an animal which the Siberian natives called by some name like *mama* or *mamont*. According to the traders, the natives described it as a kind of giant mole, which died when it unwittingly broke through the earth's crust. Although the word evolved into "mammoth," nobody has ever firmly established the origin of the name, either in Russian or in any Siberian language.

In the late eighteenth century, a German professor, Johann Blumenbach, had been collecting and sorting fossils. In 1799 he announced that he had found a new species of extinct elephant, which he named *Elephas primigenius*, "first-born elephant"—that is, the mammoth.

In the same year, a Tunguz living at the mouth of the Lena River in eastern Siberia, Ossip Shumakhov, came upon a dark frozen hillock whence protruded a tusk. Shumakhov approached the thing gingerly, because the Tunguz believed that to find a whole mammoth was bad luck. During the next few years, the mound gradually thawed in summer, exposing more and more of the mammoth. Shumakhov nerved himself to fetch a Russian to the site, where the latter bought the tusks.

In 1806 Professor Michael Adams of the University of St. Petersburg arrived at the scene. By then, wolves and Tunguz dogs had eaten all the soft parts except a few patches of hairy hide. Still, Adams collected the remains and mounted them in St. Petersburg. So it became known that there had indeed been a species of hairy elephant, now extinct.

Or was it? North America was still largely unexplored, and rumors buzzed of monsters in the interior. Two early British wanderers in the wilderness had told of seeing American Indians hunting huge, shaggy, flop-eared animals. The Delawares cherished a legend of a herd of monstrous animals, the "big bison," which descended upon the land and began destroying its native fauna until one of the gods blasted the marauders with thunderbolts.

In mid-eighteenth century, George Croghan found a deposit of huge fossil bones at Big Bone Lick, Kentucky, and sent samples to Europe. Later, Thomas Jefferson acquired a passion for fossils. Aft-

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er he became President in 1801, he obtained a collection of "mammoth" bones from Big Bone Lick, which he stored in a wing of the White House. When he sent out the Lewis and Clark Expedition in 1804, he told Lewis and Clark to look for live mammoths along with the Great Salt Mountain, the river of brine, the mountain of crystal, and other rumored wonders. Alas! Lewis and Clark found no live mammoths, although they did collect volumes of useful information. Probably all the live-mammoth stories originated in the sight of gigantic fossil skeletons like those of Big Bone Lick.

Actually, Jefferson's bones were not of mammoths but of mastodons. The American mastodon was, like the mammoth, a hairy elephant-like animal, more primitive than the mammoth and other true elephants. From Jefferson's time to the present, a number of splendid specimens of this beast have been mounted in American museums.

Throughout the nineteenth century, more tales drifted out of Siberia of mammoths preserved in the frozen muck. Scientists who investigated, however, arrived to find either that the story was a hoax or that the remains had decayed or been eaten by predators. In 1900 word came to the Russian Academy of Sciences of another frozen mammoth, on the Berëzovka[4] River, in the thinly-peopled northeastern peninsula of Siberia. After terrific exertions, a Russian expedition reached the spot and recovered the skin and the skeleton.

Although dogs and wolves had eaten parts of the trunk, face, and one foreleg, the specimen was still the most complete mammoth that has yet been collected. It was mounted in the museum at St. Petersburg (now Leningrad). Its coat consisted of a thick yellowish undercoat mixed with dark bristles up to 14 inches long. The meat was avidly eaten by the dogs, although the Russians could not quite bring themselves to try it.

As the nineteenth century advanced, scientists saw that the two living species of elephant were only the survivors of a large and complicated group of animals, which they named the order Proboscidea. There were many different genera of elephants and many of mastodons.

In the early 1900s, fossils of the early ancestors of the proboscideans turned up in Egypt. These fossils were of Eocene and early Oligocene age. The smallest was the pig-sized *Moeritherium*,[5] a swamp and fresh-water dweller who must have looked a little like the modern pygmy hippopotamus or the South American capybara.

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[4] *Pronounced bair-YAW-zoff-ka.*
[5] *Pronounced meer-i-THEER-ee-um.*

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Another Egyptian proboscidean was *Phiomia,* a larger and more advanced form something like a modern tapir, with a long snout and definite tusks in the upper and lower jaws. These fossils proved that the elephants' closest modern relatives are two groups of most unelephantlike beasts: the hyraxes or conies, and the sirenians or manatees and dugongs.

The greatest classifier of the Proboseidea was Henry Fairfield Osborn (1857-1935), the leading American paleontologist of the early twentieth century. Osborn's *magnum opus*—the last of a number of huge treatises by him on the evolution of life and of man—was a two-volume work, *Proboscidea,* published after Osborn's death. These books were printed in a size fittingly called "elephant quarto" and together weigh 25 pounds. Osborn proposed many radical revisions in the picture of the evolution of these animals. Not all other paleontologists agreed, but Osborn's classification will do until a better comes along.

Osborn divided the order Proboscidea into five suborders: the moeritheres, dinotheres, mastodonts, stegodonts, and elephants.[6] Of these, the moeritheres from Egypt were the smallest, earliest, and most primitive.

Two suborders, the dinotheres and mastodonts, branched off from the moeritheres, probably in the early Eocene. The dinotheres dwelt in Europe, Asia, and Africa. They evolved parallel to the mastodonts but along a line of their own. They grew larger and acquired the typical elephantine body form, complete with trunk.

But the dinotheres differed from other proboscideans. For one thing, they kept an ordinary set of grinding teeth, without the peculiar arrangement of elephants. The elephants have enormous molars, only one or two of which are in place on each side of each jaw at a time. These teeth replace one another horizontally, one after another. They appear at the back of the jaw, move slowly forward, and fall out the front when worn out.

Dinotheres also lost their upper tusks, while the lower tusks came to curve down like the tusks of a walrus in the wrong jaw. Nobody knows the reason for this peculiar arrangement. One dinothere, *Dinotherium gigantissimum* from the Pliocene of southeastern Europe, reached a shoulder height of over 12 feet 9 inches, rivaling the Fénkovi elephant and the larger mammoths. Another species, *D. hopwoodi,* survived to the middle Pleistocene in central Africa.

The mastodonts are a much larger and more complex array. Osborn divided them into four families and fifteen subfamilies. I

[6] *Properly speaking the Moeritheriodea, Dinotheroidea, Mastodontoidea, Stegodontoidea and Elephantoidea.*

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will not bewilder you by naming all these groups but will simply describe the general directions in which these animals evolved. Often one subfamily evolved in the same direction as another, so that the two lines of descent ended up looking much alike, although there had been no blood relationship between them since they originally split apart many millions of years before. This process is called parallel evolution.

The mastodonts were great travelers. They spread from the Old World not only to North America (in the Miocene) but also to South America. As eons passed, all the mastodonts became larger until they ranked with modern elephants in size. They all tended to shift from the normal mammalian dental arrangement to that of the elephant.

In other respects the mastodonts diverged widely. Of the fifteen subfamilies, three kept skulls of moderate length, like those of the early *Phiomia,* with four short tusks: two in the upper jaw curving down and two in the lower slanting up. (These tusks evolved from *Moeritherium's* incisors, instead of from the canines as with most tusked mammals.) As the animals grew taller, their trunks lengthened to enable them to reach the ground.

In two other subfamilies the skull, the lower jaw, and the tusks all lengthened, so that, as it became taller the animal could still reach the ground with its mouth. The trunk remained short and stubby. The upper and lower tusks crossed with a scissors action, useful for gathering food. One of these long-snouted mastodonts, *Morrillia,* may have survived to the middle Pleistocene in the midwestern United States.

In two other subfamilies, the skull and jaw lengthened, but the tusks developed differently. The upper tusks shrank while the lower ones broadened to make a scoop or shovel. The jaws of these shoveltuskers were evidently designed for digging up water plants, especially water-lily roots.

Another subfamily carried this development even further. The lower tusks disappeared, leaving the huge scoop, whose end was no doubt protected by a horny lip or bill. These spoonbill mastodonts must have fed on very soft water plants.

In the remaining seven subfamilies, the skull shortened, while the lower tusks shrank and disappeared. The upper tusks developed variously. In some genera they curved gently upward as in modern elephants. In some they were hooked sharply upward; in some they curved downward; and in some, like *Anancus* from Pleistocene Europe, they were long and nearly straight.

Two genera of Mastodonts reached South America. One was

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a small mountain type, *Cordillerion,* whose tusks had a corkscrew twist in the direction opposite to that of most proboscideans. That is to say, its right tusk was twisted to the right and is left tusk to the left.

Another genus, larger and more ordinary-looking, was *Cuvieronius.* Remains of Cuvieronius have been found in Ecuador in association with human artifacts, which the discoverer assigned on archeological grounds to the third century C.E. If this dating is correct, the animal must have been living when the first semi-civilized states arose among the South American Indians.

The best-known of all the mastodonts is the American mastodon, *M. americanus,* which roamed North America in enormous numbers during the Pleistocene. It was a bulky animal, averaging around 9 feet 6 inches in height but reaching at least 10 feet 2 inches. It was probably heavier than a modern elephant of the same height because its body was longer. It was covered with coarse golden-brown hair, of which samples have been found in swamps. A closely related form lived in Russia.

In the Miocene, a group of proboscideans called stegodonts branched off from the mastodonts. A little later, the true elephants in turn branched off from the stegodonts. The stegodonts are thus intermediate between the mastodonts and the true elephants. And this brings us to the true elephants, the suborder Elephantoidea and the family Elephantidae. Osborn divided them into three subfamilies: the Loxodontinae (the African elephant and its relatives); the Elephantinae (the Indian elephant and its king); and the Mammontinae or mammoths.

The loxodontines were confined to the Old World. One genus, *Hesperoloxodon* (sometimes called the "straight-tusked elephant") dwelt in Europe during the warm interglacial phases of the Pleistocene period. This elephant was a giant, standing over 12 feet 4 inches at the shoulder. Although more closely related to the modern African elephant, it *looked,* with its twin-domed head and small ears, more like an oversized, long-tusked Indian elephant. Another genus, *Palaeoloxodon,* evolved dwarf species on the islands of the Mediterranean. The smallest, *P. falconeri* of Malta, was less than a yard high.

The elephantines, limited to Asia, were mainly distinguished by curious bony crests on top of their skulls.

Lastly come the mammoths. Some paleontologists limit the name "mammoth" to the northern or wooly species to which the name was originally applied. They call it the "true" mammoth. However, since there is a shortage of good common names for these animals, we shall use the word for

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the whole subfamily, which includes some of the most spectacular mammals ever to bestride the globe.

There are three genera of mammontines: *Mammonteus,* the "true" or northern mammoth; *Archidiskodon,* a warm-climate genus; and *Parelephas,* inhabiting the temperate zones between the other two. All three genera occur in the New and Old Worlds. Some of the many species of *Archidiskodon* and *Parelephas* have common names,[7] but there are no good common names for the genera as a whole. For *Archidiskodon,* therefore, I shall use the name "southern mammoth." For *Parelephas,* "temperate-zone mammoth" does not sound good, so I propose to call it the favonian mammoth, which means more or less the same thing.

During the Pleistocene there were four advances of the ice, with warm spells in between. During each cold spell the arctic animals like the northern mammoth, the woolly rhinoceros, and the reindeer moved southwards, while the warm-weather faunas retreated before them. In the interglacial periods, the opposite movement took place.

The northern mammoth—*the* mammoth, if you insist—is the best-known of all prehistoric animals. Besides the skeletons and frozen carcasses that have been found, we have pictures of the animal painted on the walls of caves in southwestern France by the Crô-Magnard people, who overran Europe as the glaciers of the fourth glacial period retreated. The paintings, no doubt executed as hunting magic, show the prominent hump over the head and the smaller hump over the shoulders. These humps were probably reservoirs of fat like the camel's hump. The back sloped steeply from shoulder to haunch, thus easily shedding snow and sleet but not being well suited to bearing a howdah. There are also a few Crô-Magnard[8] paintings of the straight-tusked elephant.

Despite our use of "mammoth" to mean "gigantic," the northern mammoth was not the largest elephantid. Its average height was around nine feet, about that of the bull Indian elephant, and the northern mammoth was shorter in body. However, one *Mammonteus* skeleton from Austria towers 12 feet 10 inches.

If the northern mammoth was of only moderate size, its cousins upheld the honor of the subfamily. Twelve-footers were common among them. The largest probosci-

[7] *For* Archidiskodon *(ar-kid-ISS-ko-don), the southern and the imperial mammoth; for* Parelephas, *the Columbian and the Jeffersonian mammoth.*

[8] *Before somebody picks me up on this, "Crô-Magnon" is the name of the rock shelter for which these people were named; "Crô-Magnard" is the French adjective derived from "Crô-Magnon."*

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dean known is the Mosbach mammoth, *Parelephas trogontherii,* from Germany. A fragmentary skeleton indicates an animal with a shoulder height of at least 14 feet 9 inches. It must have weighed around 20 tons. The runner-up is a specimen of *Archidiskodon maibeni* from Nebraska, which topped 13 feet 4 inches.

Of the two, the favonian mammoth (*Parelephas*) was tall but short in body, while the southern mammoth (*Archidiskodon*) was big all over. The favonian mammoth ranged over the northern, eastern, and southeastern United States, central Europe, and probably central Asia. A few reached South America. In Europe it shared its range with the straight-tusked elephant. They did not, however, compete, because the favonian mammoth was a grazer and plains dweller while the other was a browser and forest dweller.

The southern mammoth, descended from smaller South American forms, lived in southern Europe, southern Asia, the central and southwestern United States, and Mexico. A dwarf species dwelt on the islands off the coast of California. Judging by their habitats, the southern mammoth was probably hairless, while the favonian mammoth probably had a medium coat of hair, shorter than that of the northern mammoth.

All the later and larger mammoths had very long tusks with a helical twist. On each side they curved down, out, up, and in. The tusks of old bulls often crossed at the tips. These tusks would have been useless for digging and not very good for fighting. Then what were they for?

It is a good rule of biology that, when an organism possesses a seemingly useless organ, the organ probably has a use that we do not know about. Otherwise the evolutionary process called *rudimentation* would have destroyed the organ. In the case of the mammoths, there are several theories about their curly tusks. Perhaps the most plausible is that they were used as snow shovels, to get at food in winter. The adult bulls swept away the snow, while the rest followed to eat anything left.

During the fourth glacial advance, Neanderthal man hunted proboscideans and other game over a vast area of Europe, the Near East, and Russia. I need not introduce you to Neanderthal man, except to say that some anthropologists class him as a separate *race,* some a distinct *species,* and some a distinct *genus* of man. Although his differences from modern man are well known, we need not exaggerate them. In fact, I once met a former heavyweight champion who, if he let his whiskers grow and dressed in bearskins, could step into a Neanderthal camp without causing a comment.

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Shortly after the ice of the fourth glaciation began its retreat, Neanderthal man gave way to modern man. In Europe the change seems to have been abrupt, with little or no interbreeding between *Homo sapiens* and *Homo neanderthalensis*. In the Near East, on the other hand, interbreeding does seem to have taken place, giving rise to intermediate types.

Although the Crô-Magnards and other groups of *H. sapiens* were perhaps more skillful hunters than their Neanderthal predecessors, it was not their hunting that drove the mammoths from Europe. The ice did not go away all at once. Following the fourth glaciation there ensued a Postglacial Period of several thousand years, with a see-saw climate, during which mammoths persisted. Then the climate definitely turned warm and wet. The new climate covered Europe with dense hardwood forests in place of the former steppes and tundras. Thereupon the steppe and tundra animals, such as the mammoth and the reindeer, retreated to Siberia.

There has been much speculation about the "mass deaths" of mammoths. In several places in Europe, Russia, and Siberia, remains of whole herds of mammoths have been found. Evidently the animals of each herd died in a common disaster.

For example, at Predmost, Czechoslovakia, remains were found of 600 mammoths. These animals had been eaten by Postglacial men in one small area, and their bones had been sorted and stacked. While the Predmost people could have killed that many mammoths over a long period, they could not have hauled them to one site. Therefore these mammoths probably belonged to a herd that died from natural causes, such as a blizzard, an epidemic, a quicksand, or a sudden thaw that trapped them in a previously frozen bog.

A similar site was unearthed at Pushkari, northeast of Kiev in the Ukraine. There is—despite what some people say—no reason to think that these mass deaths happened at the same time all over Europe and Siberia as a result of some Atlantean subsidence, cometary collision, or other cosmic catastrophe. The fact that a herd died all at once is no evidence that the entire species perished at that moment.

At the end of the Pleistocene, however, occurred a great and mysterious wave of extinction of large mammals on all the continents. Although hunting by early men may have helped some species towards extinction, it cannot have been the main factor, because the men of that time were too few and too feebly armed.

Early men—or manlike primates—had of course coexisted

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with proboscideans, including four-tusked mastodonts and dinotheres, in the Old World for many millions of years. In Pleistocene Europe they pursued the three mammoths and the straight-tusked elephant. (Such large animals were hunted by traps and pitfalls rather than by direct assault.) There were many species of proboscideans in Pleistocene Asia and Africa. When men arrived in North America ten to fifteen thousand years ago, they found the three mammoths and the American mastodon. In South America lived two genera of mastodons and some favonian mammoths.

When recorded history began, about 5,000 years ago, all but three species had disappeared. In addition to their present ranges, the African elephant was found in North Africa, while the Indian elephant was scattered over the Middle East, from Syria to western India, whence it has now disappeared. In South America, mastodons of the genus *Cuvieronius* still roamed. They may have survived to the rise of the mysterious pre-Inca Tiahuanaco Empire. Then they, too, vanished.

Much has been made of a Mayan monument called Stela B, at Copán, which flourished roughly from +500 to +800. On the top of this monolith are carved two creatures that look somewhat like elephants. These figures have been used to support diffusionist, heliolithic, Atlantean, and other eccentric theories of the origin of the American Indians, on the assumption that they did actually portray elephants.

Having taken a good look at this monument at Copán last year, I assure you that this is not the case. The "elephants" have nostrils, not at the ends of their "trunks" as elephants should, but in front, at the roots of these organs. Furthermore, they have large round eyes surrounded by feathers. Feathered elephants, as you know, are extremely rare; these are probably conventionalized macaws.

Of all the ancient peoples who came in contact with proboscideans, only the East Indians of the Harappa culture thought to tame them. None of the others—American Indians, African Negroes, ancient Moroccans and Syrians—did, although the Egyptians and Carthaginians of classical times domesticated African elephants for war when they had learned the trick from the Indians.

The Kindly Editor asks me: how do we know the Carthaginians did not tame Moroccan elephants for war on their own, before they heard about the technique from Greeks who had brought it from India? Well, thanks to Diodoros the Sicilian, we know quite a lot about the wars between the Greeks and the Carthaginians in Sicily during the century before Alexander. Diodoros makes no mention of

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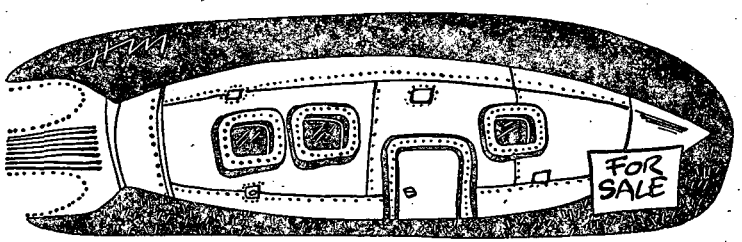
any Carthaginian elephants during this time, which he would almost certainly have done if they had used any. And Alexander and his successors, of course, brought the Indian war elephant to the West. [Humpph.—Ed.]

So now you know the elephant situation in Atlantean, Hyborian, and Tolkienian times. Proboscideans are not the largest land animals, or even the largest land mammals. In Oligocene Asia dwelt a long-legged, long-necked, hornless rhinoceros, *Baluchitherium,* standing 16 to 18 feet high. The sauropod dinosaurs were larger yet. Some were over 75 feet long and probably weighed 30 to 50 tons. Whales are even bigger; a blue whale may measure over 100 feet long and weigh between 100 and 150 tons.

However, even if we neglect the dinosaurs and the mammoths and the Fénkovi elephant, an ordinary three-ton Indian cow elephant, such as you see at the circus, is still a lot of animal—too much, in fact, to be handled in anything but the most careful and cautious manner.



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Robin Scott describes himself as "the son of a one-time subscriber to Hugo Gernsbach's The Boy Experimenter." *And goes on to say: "Truly, the sins of the father are visited upon the sons, and I cut my teeth on the old* Thrilling Wonder Stories *which—along with other pulps of the same genre—accumulated in great mouldy piles under the cellar steps. Since those cheerful days in the kindergarten of the Atomic Age, I have managed to pick up a wife, four children, a four year hitch in the Navy, a PhD (English), and my current job as publications editor (civilian) with the United States Army in Germany."*

If a person who is well adjusted to his environment is "normal", what happens when he is suddenly removed to a drastically different environment, such as that of an orbital test station? Answer: Decidedly unpleasant things. If this story's view of human nature is not a reassuring one, its logic is convincing and its dramatic impact considerable. And, in any event, Science Fiction has never been noted for its bland or reassuring nature.

THE GRITSCH SYSTEM

by Robin Scott

ANDERSON AND FERRANI LAY floating side by side in the hub passageway, trying to finish the final alignment of one of the ion injector units. The near weightlessness in at the hub made it particularly ticklish work, and used as they both were to dealing with the unchecked momentum of small parts accidentally nudged out of the net sacks in which they were carried, it was a tiresome business to recover a small relay assembly or a connector block which had been "dropped" and which had enough velocity to keep it ricocheting slowly around the passageway for hours.

Anderson braced himself against a pair of handholds, started a locknut up the threads of the spindle which would carry the vernier controls, and then adjusted a small crescent wrench for the

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final tightening. Anderson was tired and very conscious of Ferrani's knowing eyes upon him, Ferrani the fine young mechanic who did everything with such sure deftness. He slipped the jaws of the wrench onto the nut and turned it steadily home. As it began to tighten, the crescent slipped and spun slowly off, bumping from one resilient side of the passageway to another. Anderson stabbed after it hopelessly with his right hand and missed, and he cursed and cursed, tonelessly, mechanically, the way a man curses when he is angry with himself; the way a woman, after the first shock of disappointment, sobs.

The unpleasant looking fat man in his office out in the rim, sixty meters away, watched Anderson on a tiny screen slightly smaller than the light switch on the wall under which it was normally concealed. The resolution was good; the fat man had seen Anderson's covert glances at Ferrani, had seen the look on his face when he had lost the wrench. And he had heard the cursing. He snapped the switch cover down, pulled a micro-file from a drawer equipped with a heavy electronic lock, placed the file under the reader for a few seconds, returned it and relocked the drawer, and let himself out of his narrow cubicle.

Anderson and Ferrani were in their work when the fat man silently approached them down the nearest spoke. Ferrani was probing deep into the interior of the unit with a long plastic screw driver; Anderson was directing the light from a portable torch in through an access port so that Ferrani could see whatever it was he was trying to manipulate. The fat man paused and watched the pair for a moment from the cover of the spoke. He didn't like it much in at the hub. The slight centrifugal pseudogravity of his quarters out at the rim was more comfortable for him, although his newly acquired bulk bothered him somewhat less here in at the hub. When he could tell by the intake of breath, the tongue clenched between teeth, that Ferrani was about to accomplish whatever it was he wanted to do with that long plastic screwdriver, the fat man moved.

He moved quietly for a big man, a big man gone to fat. Before the two scientists were really aware of his presence he had thrust himself roughly past them, knocking Anderson to the side of the passageway and jarring Ferrani's screwdriver hand violently. Something inside the injector gave a brittle, tinkling snap, and both men whirled on the fat man, their eyes blazing with angry frustration.

Ferrani said, "My God! I might have known it was you, Gritsch."

Anderson's reaction was more violent. Before he had joined the

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Plasma Project he had been one of those quiet, confident men who never raise their voices above a well-mannered murmur. His students at M.I.T. had found it difficult to hear him beyond the first two or three rows of his always crowded lecture room in the Cryogenics Laboratory. But Anderson had been away from earth—away from the reassuring routine of home and classroom and laboratory—for over 250 orbits, nearly sixteen weeks at the high orbital altitude the Plasma Project required. Anderson the respected teacher, Anderson the scholar (27 papers and co-author of two important monographs before his 40th birthday), Anderson the Husband, Father, Lover had been away for a long time. And now Anderson the indifferent mechanic—feeling the competition with Ferrani, who was younger and more dexterous (although obviously not Anderson's match as scholar-teacher-husband-father-lover)—Anderson the mechanic was murderously angry. His knuckles white on the torch, he thrust his face into the fat man's. "Gritsch!" he screamed, his voice rising to a tremolo of lost control, "Gritsch! Get out of here! Get back to the rim, you fat bastard, and leave Ferra- and leave us alone!" Anderson's heart swelled with righteousness as he shouted. If Anderson the mechanic dropped wrenches, by God *Professor* Anderson, successful teacher-scholar-husband-father-lover, could certainly get rid of that idiot Gritsch so that Ferrani could get on with the work.

Gritsch paused in his lurching swim down the passageway away from Anderson's ire. He checked his momentum with a handhold, turned, and stared back at the two men with a long, haughty look, pointedly ignoring their anger. He wrinkled his nose in distaste, and in an affected, slightly effeminate accent which seemed to embody the worst of Back Bay and Berkley Square, he said mockingly, "Oh I *do* apologize, gentlemen, *really* I do. But after all, just because you've been mucking about out here for lit'rally *weeks* doing a bit of a job that any country plumber could bloody-well do in *hours,* you mustn't come to believe you own the flipping passageway!"

Audibly whining, Anderson gritted his teeth and swung wildly, without warning. Gritsch caught the blow expertly on his right shoulder, rolled with it, and let its momentum carry him back out of reach to the side of the passageway. He was not hurt, but he feigned a yelp of pain and covered his head with his arms. Anderson pushed after him and landed a kick in the padding around the fat man's hips and kidneys. Gritsch pushed off "down" the nearest spoke, sounding off all the time with a series of small whoops

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and wails. A last kick from Anderson caught him at the plastic shield he wore downward from his belt and shot him with renewed velocity "down" the spoke, out toward the rim. A few seconds later, hidden in a service niche in the spoke, Gritsch heard Anderson's shuddering intake of breath, heard Ferrani's congratulations, heard Anderson's quiet boast about how they had fixed that son-of-a-bitch Gritsch. The fat man listened for a moment, a curious smile on his face, and then shoved off "downward" again to his cubicle in the rim.

Inside, seated on his bunk, Gritsch stripped off his shirt to check the damage. Under the layers of new fat he had acquired, the muscle tone was still good. (Whenever he thought of muscle tone, he remembered his old P.T. instructor in the army saying, as his class lay exhausted and drained on the mats, "Don't just lie there, men; do pushups!") There would be a good big bruise, and although ruptured blood vessels and skin lesions could be a problem under conditions of low gravity and air pressure, Anderson hadn't hit him *that* hard. Still, he had to be careful. This wasn't the first time some one had taken a swing at him, and he could expect a good deal more of this kind of violence before his part in the Plasma Project was done with. He was pretty well padded—with new fat over much of his upper body, with carefully fitted padding elsewhere—but Anderson's reaction was an indication of what he could expect with increasing frequency as the dangerous work of the Project neared its climax.

Satisfied that the damage was slight and that he needed no treatment, Gritsch rose to the light switch, depressed a series of studs on its underside, and waited for the Project Director to answer up from his office on the opposite side of the great wheel of the Plasma Station.

"Yes, Walt." The Director's voice was almost inaudible to Gritsch, even with his ear only inches away from the wall switch.

"I got a good one out of Anderson," said Gritsch.

"Good! Walt. Wonderful!" There was real elation in the Director's voice. He had been worried about the Ferrani-Anderson team. "That team's been a problem. They're way behind on the injector installations." As men do with their confidants when they feel themselves beset with problems, confused with the sheer multiplicity of their responsibilities, the Director rambled, thinking out loud. "If we don't get the injectors set up before the field coils are ready, we'll lose time on preliminary testing. . . . I suppose it's something about Anderson and Ferrani . . . Maybe I ought to split the team up . . . Anderson isn't

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much goods with his hands, but without his direction, Ferrani's a plumber . . ."

Gritsch cleared his throat, and the Director broke off in mid-phrase. "I'm sorry, Walt. In this job I'm supposed to know everybody's business, and I forget to be careful not to lecture my specialists on their specialties."

Gritsch chuckled. "You need release just like everybody else, Ed. If you can get it by being pedantic about my work instead of taking a whack at me, I'm in favor." Gritsch tried without much success to drop the arrogance from his voice along with the Berkley Square accent. "Anyway," he continued, "Anderson got a pretty good purge. I expect he feels like a man again, and I don't think he'll be so concerned about competing with Ferrani on the manual level anymore. He exploded like a mother hen protecting a chick when I harassed Ferrani."

The Director was silent for a moment. Then, his voice sober, he asked, "Much damage, Walt?"

"Of course not. Stop worrying. Just bruises." Then, suddenly aware of the terrible sincerity of the older man's concern, Gritsch added, "Being larded up like a Japanese wrestler had its advantages, Ed."

"Walt . . . I—I wish there were some other way."

"Well there isn't. And we don't even know if this way will work." Gritsch rested his forehead against the pale green vinyl wall beside the light switch. Even under the light pseudo-gravity of the rim, the support eased his aching shoulder. He was tired, and his padding was chafing him. "Anyway, Ed," he continued, trying to relieve the Director from any sense of personal responsibility for his aches and bruises, "save your sympathy. The damage to my fat hide is slight, and I'm one of those actors who doesn't require a large audience; your applause is gratefully received, and it is enough." He paused before continuing, trying to find just the right words to set the older man at ease. "You must realize," he said earnestly, "what a great role this is. There isn't an actor anywhere who wouldn't give his eyeteeth for it."

"Okay, Walt," said the Director, "don't waste your psychology on me." He was silent for a moment. "But of course, you're right. I need reassurance too. It is likewise gratefully received. And I will now dutifully recite rationalizations numbered one, two, and three: 'Walt Knows What The Hell He Is Doing. He Will Not Be Hurt Beyond Repair. This Is The Best Way To Keep Twelve Captive Geniuses From Scattering Their Collective Marbles Across 25,000 Miles Of Orbit-Track.' Okay, Walt, but it still doesn't seem right for one man to take on all the grief of twelve."

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Gritsch laughed wryly. "*All* the grief? You mean to tell me you have no grief? Seems to me there's a little matter of seven billion dollars of Uncle Sugar's money that have been spent to space-test the world's first plasma drive, and we ain't testing yet."

There was a pained grunt from the Director. Gritsch could imagine him at his desk, his coarse white hair cropped close, his head thrown back to hear the communicator hidden in the wall panel behind his chair, his forehead lined by the immense responsibilities of the Plasma Project. Gritsch did the Russian accent bit; it always cheered the Director. "Dun vorry, tovarish. You lok aht for da screws an' da balts an' da resta da hardsvare; I lok aht for da nuts." Gritsch heard the Director chuckle as he thumbed the actuator and broke the circuit.

Gritsch eased his body pads off and stretched out on his bunk to rest before dinner. He hadn't exaggerated; his job was a fascinating one for a sometime actor who fancied himself pretty good. And for a young psychotherapist with a string of degrees but little clinical experience, the opportunity to make a name for himself was fantastic—if, that is, he should ever be permitted to publish. That would have to wait. But the Director was right, too: it was a tough job, an unpleasant one. Gritsch was by nature a convivial man who had always been popular with his co-workers, and it was difficult for him to act boorishly toward men he respected, difficult for him to endure the loneliness and isolation his job called for. More immediately trying was his "makeup": the thirty-five pounds of flabby fat and the nauseating tablets he had to take to maintain it; the over-active subaceous glands which kept his skin oily and glistening no matter how often he washed, and the equally nauseating liquid he had to take to maintain *that;* the lank black hair that was cut too long, that hung lifelessly across his forehead; the unshaven face; the humped shoulders and shambling walk that left him tired and aching after a few hours; the dirty linen and smeared clothing: In short, all the things that made Walter Gritsch (including that name, chosen for its unpleasant sound) so thoroughly repugnant to his colleagues in the Plasma Station were just as repugnant and a good deal more unpleasant for Walter Collins, the man who played the role of Walter Gritsch.

But Walter Gritsch—rather, Walter Collins—was an essential man in the Plasma Project. Conceived early in the Plasma Project planning, Gritsch had been officially born during a brief conference which included only Project Director Ed Stewart, Alan Wilke, Chief of the Life Support Section

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and Walt's boss (a number of supervisors removed), and Walt himself. It had been more than two months before the Project Plasma launch series had started—a miserably hot day in July—when Walt has flown up to Washington from the Cape for the conference, had flown up in answer to an official summons to present and defend what he had referred to in those quiet, middle-of-the-night conversations with Nancy as "the Gritsch System." Nancy had been enthusiastic, but then that's what good wives are for, and while Walt was pleased that his write-up of the "Gritsch System" had been received well enough to gain him this opportunity for a high-level inquisition, he had no illusions about the basic conservatism of the bureaucracy in which he worked. Stewart he knew nothing about, but Wilke (whom he knew only from reputation and from his bold signature on the myriad documents circulating in endless flow through the Life Support Section) was noted for his dislike of the unorthodox and the daring, for the bluntness with which he battled those who chose to disagree with him.

The conference room was in an ancient grey temporary building tucked back of the new Smithsonian annex; one of the innumerable bits of real estate scattered about Washington into which the burgeoning Plasma Project had spread. The room was blistering and airless; the windows had been sealed to increase the efficiency of the air conditioner, which, apparently out of order, testified to the futility of the step with its silence. Walt introduced himself to the two waiting men, and after they had seated themselves around the polished mahogany table with its inevitable government chromium water carafe and clear glass ashtrays, he launched into his brief presentation in the stilted prose of the junior bureaucrat with a basket of his own fish to sell.

"Much over-simplified, the problem as presented to the Psychotherapeutics Staff of the Life Support Section was this: given twelve highly-trained, highly individualistic men, each of whom has lived for some time in a heavily structured environment replete with the reassurance mechanisms and anxiety outlets which successful and well-balanced men invariably have; given such men, we must so tailor the psychological environment of the Plasma Test Station that adequate reassurance mechanisms and anxiety outlets are provided in adequate number. Complicating the problem are such considerations as isolation—the total time in orbit will probably exceed four months—physical stress, and above all, the presence of considerable physical danger at the time of test.

"In attempting to arrive at a sat-

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isfactory solution to this problem, we have tested and discarded classic therapies of make-work, make-challenge, and escapism recreation. While recreational materials will, of course, be included in the proposed psychological environment, primary reliance cannot be put on them because of the intellective nature of the men involved and the obvious dangers of escapism in the hostile physical environment of space.

"What we have chosen then, and here propose, is the institution of a fairly elaborate variation on psychodrama: therapeutic techniques which will result in the creation of a number of dramatic situations each of which is rich in opportunities for the purging of anxieties and the revitalization of ego-enriching reassurance symbols. Unlike the orthodox psychodrama technique, however, the participants will be totally unaware that dramatic incidents are staged. Each incident will be staged and —to the extent possible—directed by the Project psychotherapist. He will not be identified as such, and he will be the only individual outside the Project Director who will be aware that the psychodramatic incidents are contrived.

"The only element that need be added in this presentation, then, is that the basic underlying psychodramatic theme will consist in a recreation of the folk-myth of the scapegoat. As you will recall, the ancient semitic tribes employed the ritualistic device of ceremonially transferring all the sins of the tribe members to a goat who was then driven from the land of the tribe into the wilderness, bearing the tribal sins with him. In the same manner, the 'Gritsch System' will act as a mechanism for the objectification of individual crew members' frustrations and anxieties in another individual—a pariah, or whipping boy, if you will—with a resulting reassertion of personal worth, a revitalization of the ego-establishment mechanism."

Walt sat down and reached for the chrome carafe. It was empty. He wanted a cigarette, but he was afraid to add more smoke to the tiny room's air, already made blue by Wilke's gurgling pipe. Neither Wilke nor Stewart spoke, and their silence conspired with the airless room and the heat to render Walt about as uncomfortable as he could ever remember being, at least since his basic training days.

Wilke finally broke the silence. "Absolute nonsense," he said. "Easily the most idiotic plan I have heard since Ferguson came up with his chlorophyl-selenium organic power cell business." Then, his voice pitched high with sarcasm, he said, "I realize you have certain unique qualifications, Collins. You have a Doctorate in Psychology from a reputable university, and you enjoy the rather dubious distinction of having played

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the second lead in that rather pornographic play of Mr. Williams some years ago, but I do not see that these accomplishments afford you license to insult our intelligence and take up our time with such complete drivel!"

Walt had expected opposition, but nothing like this. The violence of Wilke's attack left him momentarily speechless, and when he recovered, he had to fight hard to keep his temper in check, his manner civil. "I realize the 'Gritsch System' is unorthodox, Dr. Wilke, but the problem we face is pretty unorthodox too. Keeping twelve highly trained individualists from losing their grasp of reality, from being borne under by inter-personal anxieties and frustrations when they must live together in close quarters and under circumstances of extreme physical hazard, that's an unorthodox problem and it requires an unusual solution!" As he talked, Walt's anger at the older man's unreasoned opposition grew, and he was just barely able to keep his voice emotionless, his manner courteous.

Wilke answered with ice in his voice, again carefully omitting the courtesy of Walt's title. "I appreciate your passion, Collins. I understand it is essential to 'show business'. But the idea that you—or for that matter anybody—could draw upon himself the hostilities and anxieties of a number of highly educated men, fool them with this psychodrama hocus-pocus, is arrant nonsense. You are a fool, Collins, and speaking for the Life Support Section, I find your plan absurd and I oppose it, inalterably!"

Walt rose, his face white with suppressed anger at Wilke's personal attack on him. Wilke's word in the Life Support Section was law, and Walt had worked in the great American technocratic bureaucracy long enough to know that there were indeed times when you could not fight city hall. Not fighting city hall, however, can be hard on the blood pressure. So can having to swallow personal invective. Walt wasn't afraid of Wilke, of losing his job or prejudicing his future with the Plasma Project. Rather, he wanted to see the "Gritsch System" given a fair trial. He made the decision to fight Wilke in another time, under different circumstances more favorable to his cause. Walt was a bureaucrat too, and he knew something about in-fighting.

Walt's blood pressure went up, but his voice stayed down. He was an actor, and he was skilled at control. His lips tight but his voice even, he shuffled his papers carefully into his briefcase, and said quietly: "Thank you, Dr. Wilke, Dr. Stewart. I regret I have taken up your time needlessly." He flashed a cordial smile as he held out his hand to Wilke. "I have reservations on the four o'clock for the Cape, and I must go now."

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The room erupted.

Wilke slapped the top of his bald head with the flat of one hand, scattering pipe ashes far and wide, and cackled in triumph. "See, Ed? I was right. Collins is the man if anyone is!" Stewart nodded thoughtfully as he bent to reinsert the plug for the air conditioner into a baseboard receptacle. Wilke continued his crowing. Waving to the chair Walt had just left, he said, "Sit down, boy. Sit down Dr. Collins. Of course we like the 'Gritsch System.' It's a brilliant piece of work. We fat old bureaucrats can be pretty stupid, but not *that* stupid."

Walt sat down, his knees weak from astonishment at the turn events had taken. A blast of cold air from the air conditioner struck him and he began to think again. He understood, then. It had been a test.

"The only problem we had was *who,*" continued Wilke. "Who could carry it off. Who could be the scapegoat. I figured you for the job, but I had to convince Ed—Dr. Stewart—that you could take it without blowing."

Walt couldn't help smiling at the obvious triumph in the old man's face. He made a mental note never again to trust second-hand assessments of people; Wilke was quite obviously much too complex an old bird to be described simply as 'conservative.'

"Anyway, Dr. Collins," continued Wilke, a sly grin on his face, "what did you think of my little psychodrama. Not bad for a biophysicist, eh?"

Walt said, "I'm hoist on my own petard. Very fine job, sir."

"Thank you, Dr. Collins," said Wilke, suddenly sober again. "I apologize. It was dirty pool; but I believe you'll agree necessary." He turned again to Stewart. "How about it, Ed. You bought his idea; will you buy Collins as Gritsch?"

Stewart ran his large workman's fingers through his snowy crewcut. "I buy," he said. Then to Walt: "Dr. Collins, when I was a young man, early in World II, I served aboard a submarine of the old *Abalone* class. It was crowded and it stank. On war patrol we were at sea as much as six weeks at a time, and most of that submerged except at night. We were scared most of the time, too.

"We had a third class Petty Officer aboard—a Quartermaster as I recall—who was a real goof-off. He was dirty, foul-mouthed, incompetent, and a complete coward. We all grew to hate him so much that after we had petitioned the Executive Officer and the Skipper a couple of times to have him transferred, several of us cold-caulked him one night in Ulithi to persuade him to put in for a transfer. But if he did, it wasn't approved, and he was with us right through to the end of the tour.

"Some years after the war I ran

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into my old skipper at a cocktail party here in Washington, and I asked him why in hell he had kept Kovalski—that was the man's name—on the boat. I'll never forget his answer. 'Stewart,' he said, 'do you remember when you were scared to death during depth-bomb attacks who was even more scared? Do you remember who used to get sick as a dog whenever we were on diesel and the sea was running a little rough? Who always looked dirty and never got a girl on shore leave? Who was always getting kicked around by the new boots, even though he ranked them? *Do you remember who was always there for you and the other fifty-seven of us to look down on and hate and feel superior to, even though we were almost as sick and dirty and frightened as he was?* That's why I never transferred Kovalski off the boat.'

"I buy Dr. Collins' plan, and I buy Dr. Collins."

The great silver wheel that was the Project Plasma Test Station spun with deceptive slowness about its axis as it orbited the earth once every 700 minutes. Springing out like the frozen tentacles of some strange sea-beast from the inner surface of the doughnut-shaped hub, starkly black against the sunlit face of the earth, were the emitter ducts of the twelve injector units which would insert high-velocity ions into the constrictive magnetic flux generated around the inner circumference of the hub. It was these ions, heated and constricted and accelerated and heated again, that would form the plasma. And the plasma, a great pulse of energy squeezed, heated, and given direction by the intense magnetic field of the hub's superconductive coils, would drive the wheel along its axis, slowly, almost imperceptibly at first, but eventually, with each increment of acceleration adding to the total velocity, with a speed that made even the nearest stars not impossible of attainment. That's what the planners said, the theoreticians. But how do you test a plasma drive? Where do you find the cold that will allow a wire the size of a pencil lead to carry a thousand amperes? Where do you find the vacuum hard enough to let you heat ions to a fusion ignition point of 100,000,000 degrees fahrenheit and at the same time achieve a degree of magneto-hydrodynamic stability high enough to contain the unimaginably fierce reaction? Where do you stand back in safety when all this is going on? The answer is, you find all these—except the safe place to stand—in space. The answer is, you spend seven billion dollars, and you find twelve—no, thirteen—brave men, and you launch them into high orbit for five months. That's what you do if you want to test a plasma drive.

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Walt stood with one foot on his bunk, wrapping surgical tape around his left knee. He would limp for a while. In the three weeks since the Anderson attack he had been the object of more and more violence. This last was the worst. Svenson had gone after him with a screwdriver, and the dull blade had left a ragged four inch gash across Walt's left kneecap.

The annunciator behind the wall switch emitted a brief 15,000 cycle whistle. If you didn't have exceptionally good hearing and weren't expecting it, you would never hear it. Walt slipped his coverall leg down over the new tape and leaned his head against the wall near the switch. "Yeah, Ed."

"I just heard about the scrape with Svenson. Are you all right?" Stewart sounded worried.

"I'm okay." Walt couldn't keep the fatigue out of his voice. The wound wasn't, in fact, dangerous. But he was worn out just with keeping himself in one piece.

"Listen, Walt, this is the end. I'm going to put an end to it. You might not be so lucky next time. The way I hear it, Svenson was really after your blood."

"Well, he got some, and I think he's satisfied."

"Satisfied, hell!" the Director exploded. "This whole thing has gone far enough, and I'm going to stop it before someone gets really hurt."

Walt realized with a shock that there was near panic in the Director's voice. It wasn't just Svenson's attack. There was something else. "Ed, I'm coming over to your office."

"Yes, I guess you'd better, Walt," said the Director, a note of weary finality in his voice.

Walt made his way along the rim passageway, paused before the Director's door to make sure no one could observe his entry, and let himself in with one swift movement. The Director sat at his desk, his eyes closed, one large hand nervously kneading the other. The strain was written on his face in bold strokes; his hair looked yellowed, his complexion sallow. Walt locked the door behind him and stood, his left knee throbbing, until the Director opened his eyes. It was distressing to see Stewart like this. Over the months the two men had become exceedingly close, despite the difference in their ages. They shared a secret and a hope, and they were confidants.

"Sit down Walt," said Stewart. "I'm gratified to discover no screwdriver handles protruding from you."

"I'm gratified you can still make a jest, even a sick one like that."

The Director sat silently for a moment, staring into space, his hands picking at each other. Then slowly, choosing his words carefully, he said, "Walt, the 'Gritsch System' has done its work, and I'm 'retiring' Gritsch to his quarters for the duration."

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Walt had half expected this. He said quietly, "Why Ed? What are your motives? Are you worried about my hide?"

"Yes, Damnit," exploded Stewart. "That and some other things. I don't want to see you sent home in a sheet. And I don't want to have to handle the guy that finally does you in. But I could live with that. I could bear it. What I can't put up with is that you—Gritsch—are disrupting the Project. Gritsch has outlived his usefulness. He's a liability to the Project now!"

Because he reciprocated it, Walt was aware of the degree of the Director's affection for him, and he puzzled at the Director's words. How much of his new opposition to the 'Gritsch System' was real? How much was the result of his concern for Walt's life? He probed: "Ed, I agree that the 'Gritsch System' has lost some of its efficacy. This is inevitable; people can get used to anything, even a mess like Gritsch. But being ineffectual is a long way from 'disruption.' Just how is Gritsch 'disrupting' the project?"

"How?" exclaimed the Director, his voice agitated, "How the hell should I know 'how'? *I'm* not the psychotherapist. The point is the Project is going to hell in a hand basket." His hands ceased their dance, and he sat forward rigidly in his chair, his eyes bright with emotion. "If it isn't Gritsch, what is it? The Project is getting absolutely nowhere. We're as ready now as we'll ever be to test. All the gear is installed and checked-out. The injectors have all been individually fired; continuity on the field is perfect. We've programmed for the big one, the final test, but nobody wants to go ahead. Everybody has a dandy excuse for delaying 'just one more day' or for 'just one more dry run.' " Stewart leaned back in his chair, his eyes closed in fatigue. "Anyway, Walt, I'm not taking any more chances. The 'Gritsch System' has worked wonders, but it's all over now, and I'm confining you to your quarters until after test."

Walt lifted his injured leg onto the bunk where he lay half reclining. "Let's separate two things here, Ed. First, this question of my hide. I'm no more anxious than you are to see Walt Collins shuffle off the old mortal coil at the tender age of thirty-one. Okay. If the Project is ready for the big test, then Gritsch's work is done, and I will retire gladly. I will even put in for unemployment compensation and sit in my cabin drinking the government's fine medicinal alcohol until re-entry.

"So much for my hide. Now about this general reluctance to go ahead with the big test. It's not so strange, and I'm sure it has nothing to do with Gritsch."

Stewart pursed his lips and shook his head skeptically.

"Ed," continued Walt, "do you

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remember when you got married? How confused you were for those few moments before the ceremony? You wanted to take the big step; you couldn't imagine life without your bride-to-be. Still, you hesitated at the sheer irrevocability of the event. Once done, it couldn't be undone. It's buck fever, Ed. Man is always afraid of the irrevocable. To have the potential of success is much more comforting than to risk that potential for the actuality of a test."

Stewart retained his skeptical look. "It may be buck fever, but it's aggravated by 'Gritsch fever'."

"No, Ed! It has nothing to do with Gritsch! Look, do you remember when you were in graduate school how many graduate students hung around, semester after semester, working at miserable jobs in laboratories for miserable pay, afraid to complete examinations or finish dissertations? Afraid to risk the honorable status of an aspiring student by taking a chance on failure? That's what you've got here. No one knows if the drive will work, and it's very natural for these men to want to delay the moment of truth. That's mankind, Ed. He never knows, and he never wants to make an irrevocable decision."

Stewart looked at the younger man with a speculative eye. "If what you say is true," he said, "then its up to me, isn't it? What they call 'dictatorial fiat.' I'll have to make the decision to do the big one even if my crew say they aren't ready for it. That's what a Director is for. To make irrevocable decisions, to take the gamble."

"Not quite, Ed," said Walt. "Look at it this way. When you push the button for the test one of three things can happen:

"Say the test works. Big success. We'll all be famous. Mass ride down Broadway and White House reception. Fine. I'll probably be the only guy in history who's drawing unemployment compensation while a guest at the White House.

"Say the test fails, fails disasterously. The field won't hold and we'll all be broken down neatly into our constituent particles, ionized, and shot off somewhere where the green grass definitely does not grow all around, all around. Or the plasma will fire off-center and we'll get kicked out of orbit and fry or freeze to death, depending on whether we wobble into retro course or off into the wild black yonder.

"Or say the test fails, but not disastrously. It just fails. The whole thing fizzles: the plasma won't fire; the field will be too weak to bring it up to fusion-ignition; the ion injectors will malfunction; or—oh! a million things can go wrong that won't kill us, but will kill Project Plasma without a real honest-to-God, go-the-limit test. Right?"

Stewart nodded, a sick look on his face. He knew far better than

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Walt just how many things could go wrong.

Walt continued: "Ed, if you order a test purely as a function of your own will—if the test has to rest on your motivation alone—that's exactly what will happen. The test won't kill us; it'll fizzle."

"Wait a minute," said Stewart angrily, "What you say adds up to the fact that this crew hasn't the guts to take a chance with a field breakdown or an off-center firing; that they'd sooner sabotage the test than take a chance on getting fried!"

"No, that's not quite true. Take any one of them. Put him in command, and he would order the test, bull it through if necessary, just as you're thinking of doing. Give them the responsibility, and they'll measure up. But remember, Ed, inside each of us is a little guy who doesn't have any guts, who doesn't have any sense of responsibility. All he's interested in is living as long as he can with three squares a day and an occasional roll in the hay with his private 'Miss Libido of 1974'. When you or I or the next man tries to override that little guy, we've got to have a pretty good reason. We have to be motivated. And I mean motivated more than salaries, and social pressure, and hate, and curiosity can normally do. Most of all, we have to feel that if we don't do whatever it is we ought to do, no one else will; that if we don't do it, 'George' won't do it either. And if we don't do it, the price of conscience we pay will be more painful than the cry of rage from the little guy inside us."

Stewart grinned. "I didn't think you mind mechanics believed in the 'conscience'."

"What do you think makes a 'mind mechanic' decide to be a 'mind mechanic', Ed?" said Walt quietly.

Stewart pondered in silence. Then, his decision made, he said: "Okay! Okay! Maybe you're right, Walt. I don't know. But from now on Gritsch stays retired. There's nothing you can do—even if your theory is right—to get this bunch and their 'little guys' off the dime. And I'll be a lot happier if I don't have to worry about someone separating you from your liver with a sharp kick. You go back to your medicinal alcohol and I'll sign your unemployment papers. I'm sorry, Walt, but that's it."

Walt looked at the older man and smiled. "Okay, chief. Fifty-two-twenty, here I come." He swung off the bunk and slipped out the door, his mind busy with the details of the last act of the "Gritsch System."

An hour later, in full space gear, Walt fumbled in the pneumatic interior of the drawer where his personal articles were kept reasonably safe from eternal floatation. He pulled out a spool of heavy thread and read the label: "Clark & Jones.

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Button and Carpet. 250 yards. 4 Cord. Extra Strong. #462. Black. 15 Cents."

"Now what do you suppose all that means?" thought Walt. "Here is a technology I know nothing about. Anyway, I'm glad Nancy packed it for me." He slipped the spool into the pouch at the waist of his suit, moved ponderously out into the rim passageway, and made his way around to the Director's office. The soft chime announcing the 'evening' meal had sounded five minutes before, and he could be reasonably sure that everyone would be in the mess hall. He left a sealed envelope on the Director's desk and ducked up a spoke, pulling himself against the steadily decreasing pseudo-gravity toward the hub and the outer access air lock.

In the air lock, the air pressure exhausted, he twisted the outer hatch open and pulled himself into the hub, past the ion injector emitter ducts, onto the outer surface of the hub. He worked his way around the hub, as far away from the air lock hatch as possible, and then pulled himself out a few meters along the outer surface of one of the spokes. With a silent prayer for the Clark and Jones Thread Company, he tied the end of his spool of button thread to a hand hold, flipped off the power to his magnetic shoes, and with a flick of his index finger, sent himself outward parallel to the ring axis at a very few feet per minute. He unreeled thread until he judged himself some 200 meters away from the spoke. Then with a few ounces of tension on the thread, he snubbed himself gently to a stop, made the thread and spool fast to his suit, turned his private commo circuit with the Director up to full volume and relaxed, waiting for the explosion.

It came and it was unprintable. Then it came again.

"WALT, YOU'RE CRAZY!"

Walt turned the volume down a bit. "Okay, Ed. Take it easy. Did you get my letter?"

"WHY THE HELL DID YOU DO IT!"

Walt turned the volume down a little more. "Read the letter, Ed. Read the letter."

There was a mumble and a hiss. Walt waited. "I've got all the time in the world," he thought. He looked at his air gauge. "—as long as the world doesn't last longer than twelve hours thirty-five minutes."

Stewart came back on the circuit, his voice sober. "I read the letter, Walt. Now what?"

"Ed, I want you to read it on the Station common circuit. If I've guessed right, you'll have your test shortly."

"And if you've guessed wrong?" snarled the Director.

Walt grunted. "That's my worry. Read the letter, Ed."

Walt took the ensuing profanity and silence on the other end

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for assent, and he shifted his receiver frequency to the Station common net. He didn't have to wait long.

Stewart's voice rang out with surprising firmness: "Now hear this, everybody. We have a man outside the Station, out of contact. It is Walter Gritsch. He has left a note. He has written: 'I will not write a long note. I have caused you all too much pain and anger already. My attempts at humor and camaraderie you mistook for boorishness; my attempts to be helpful you took for meddling. But it was not your fault; it was mine. For all that I have done, I ask your forgiveness. I have blocked the success of the Project through my very existence, and I will now put an end to it. I have not the courage to do so violently, and I choose this easiest of methods.' "

Walt switched back to his private circuit with the Director. There was a brief hiss of silence and then the Director spoke again, his voice weary and resigned: "All right, Walt. It's your nickel."

"Thanks, Ed. Now let them have about fifteen minutes to stew, and then call a general meeting in the mess room. Let them make suggestions about the situation; don't you do it. Watch Svenson. I think he'll be the key man."

"Walt, if you think these men are going to strain themselves to save you, you really are nuts. They hate your guts."

"Don't be too sure. Remember the basic theme of our running psychodrama, the scapegoat. The goat has been driven off into the wilderness now, bearing all the sins of the tribe, and I'll bet there is some cautious elation over there in the mess room right now. But these men are not members of a primitive tribe, and while our drama has worked pretty well on the subconscious level so far, this situation will produce some pretty careful evaluations 'way up in the forepart of the brain."

"Okay, Walt. I'll give them fifteen minutes."

"One more thing. Patch the pick-up in the mess room into my suit circuit, will you? I've done some pretty careful staging, and I'd like to catch the audience reaction."

There was a hiss and a click as the Director made the necessary patches in his office, and Walt's suit phones buzzed with the sound of several voices speaking excitedly.

". . . good riddance to the fat slob . . ."

". . . that's a little strong, Tony, but . . ."

". . . human being you know . . ."

". . . filthy, greasy, never shaved . . ."

". . . caused more trouble than . . ."

". . . if anybody ever deserved . . ."

". . . but what a way to . . ."

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"LOOK! OUT THE PORT! THERE HE IS!"

Walt recognized Anderson's high-pitched voice, and he knew what a spectacle the eleven men in the mess room saw before them. He had carefully staged the scene. He had locked his feet together by flicking on just one shoe magnet, and then he had increased his suit pressure until his two arms stood stiffly out from his sides. His timing had been perfect. The sun lay opposite him, down the axis of the great wheel of the test station, and he lay bathed in golden light. Behind him, the great smoke of the Milky Way was rising, the Coal Sack an inky companion to the four stars of the Southern Cross.

There was a dead silence from the mess room as each man took in the enormity of Gritsch's apparent fate and evaluated it in his own terms. Only one or two were *consciously* effected by the double symbolism of the cross, but all were dimly aware of it on some deeper level. Most suddenly found themselves, despite their hatred for Gritsch, identifying themselves with him. Baily, who was close to the upper tolerance for agoraphobia, saw Gritsch falling across the immensity of space for an eternity, and was struck with nausea. Kovac's tendency toward claustrophobia made him wince at the thought of the confining suit, overpressured, and the man inside apparently helpless to move his arms.

Svenson, the first man to draw blood from Gritsch, broke the silence with an agonizing cry: "My God, he's a *man*! We can't just stand by and let him die out there!"

Some three hours later, Walt watched through his helmet filter as the space in the center of the hub glowed golden, then violet, then flashed blindly for a few milliseconds. Watched as the thread which had stood straight from his waist to the Station, slackened and coiled as the distance steadily diminished. The Director's jubilant voice came over the circuit. "It worked! The test worked! We've got a drive and we're coming after you!"

As the hatchway approached, suited figures reached for Walt, snagged him, and pulled him down into the air lock. The system cycled, and they began to unsuit. His helmet off, the Director pounded Walt on the back; the others, euphoric over the success of the test and their relief at the rescue, forgot their hatred of Gritsch. The Director, likewise momentarily forgetful, addressed Walt by his first name in the presence of the others. "My God, Walt. Why did you take such a chance?"

Walt started to answer in Gritsch's Berkeley Square accent when he saw the sudden change come over the Director's face. The Director was staring fixedly at the piece of tough, black thread still

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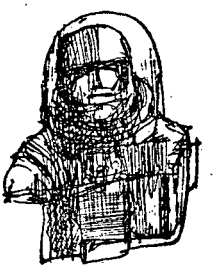
tied at Walt's waist. He looked up at Walt, his face white with fury. Biting off each word, he said: "You mean all the time you had that?" Then half to himself, "I should have known when you didn't drift, had no velocity, just sat out there . . ."

Something inside the Director broke; all the cares and worries of five long months in space found release. He swung from the floor with all his strength. Walt, practised as no one else at close order defensive boxing under conditions of weightlessness, took the blow on his upper arm, rolled back with it, and went bumbling, laughing, aching down a spoke toward his sanctuary and the liniment bottle.



Coming soon . . .

. . . next month, in fact, is ADMIRALTY, the third and final short novel in **POUL ANDERSON**'s privateer series. Although a sequel to MARQUE AND REPRISAL (Feb. 1965) and ARSENAL PORT (April 1965), this is a *complete* novel in itself, and may be read and enjoyed by any having the misfortune to miss the earlier pair. **FREDERIC BROWN**, who once called science fiction "a nightmare and a dream" will be on hand with a nightmare-shocker, replete with smoky wine-cellars, streets thick with fog, a musician with an obsession, and A LITTLE NIGHTMUSIC. Our July issue will feature **AVRAM DAVIDSON**'s ROGUE DRAGON—more about this next month.

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Our curator of biographical data just returned from the vaults with the following: "Born in Elizabeth, N. J., Deborah Crawford now writes advertising copy for airlines and banks (without knowing either the laws of aerodynamics or principals of banking), reviews books on SF and music for the Book of the Month Club, and is working on two book-length manuscripts, not SF. Her first published poem at age 12, went something like: 'What is Life? . . . HO HO I KNOW . . . God is the wheat, we are the chaff, that is Life' and was printed, all eight lines of it, in reverse order, the editor saying it sounded a little better that way. She hopes a similar fate does not await her latest." That experimental, we're not.

SHORT CUT

by Deborah Crawford

I want to be a Poet, said Georg
On his Career Day.
Standing straight and eager in the great hall
Before the Elders (the affectionate name
For the massive pile of memorizers
In the middle of the concourse).
A Poet, he said, that's all I've ever wanted.
The Elders rumbled, coughed. The first returns
Were bad. Right now the world (especially
The New Yankee States) needed five thousand other jobs
Filled by humans more urgently than that of Poet.
However, the recent editorial fuss in the newsrealies
About the Compomers having been fed all existing literature
Half a century ago, and now
Spitting out sonnets of maddening similarity
With the query: *Quotes of earlier samples desired?*—
Had led to a reversal to the human system
That evolved out of the ancient, so-called "Anguished" method
In which Poets with no invitation or guarantee

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Blindly sent forth their brain-children
To unknown publishers, indifferent public.
So the Elders mumbled, collated and produced
YES in glowing Elderese
And Georg went happily unitward
To commune with a rented Historian.

It takes a heap 'o' Hypnotape
Plus a headache (Georg never did like thotsleep)
To make a Career; but in a week he awoke
With the world's poetic output filtered
Through his conceptions, plus techniques and tips
("What public likes best: Combine
Most popular president, physician and pet".)
Excited, confident, Georg reset to "Poethink"
And began mentalizing his verse. *Ah,* he thought
The name of my epic shall be—
'Lily Cohn's Androdoc's Plutocat' and he smiled,
Already savoring the plaudits
Of part of that public, immense and waiting
At the hundred thousand receptor
Endings of the Master Collator (Verse)
In the Creative Department, Lit. Section
Of the Central Communications Building.

Out went his opus, in the eighteen major languages
With the "Slant" button pushed all the way down,
And in clicked the returns; Georg waited
Impatient, as the Collator synthesized
The entire bulk of responses into a paragraph, popped
Out on a printed piece of paper.

"We thank you," it began. "However . . ."
(And since a corollary of the First Law of Robotics is
Kindness)
"With your splendid memory for clichés
That show respect for established values,
Together with your fondness for the long, obscure word,
The pastel, amorphous concepts
That keep the reader healthily jumping up
To consult his Cyclopedia

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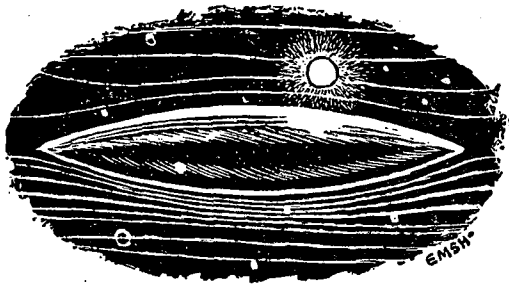
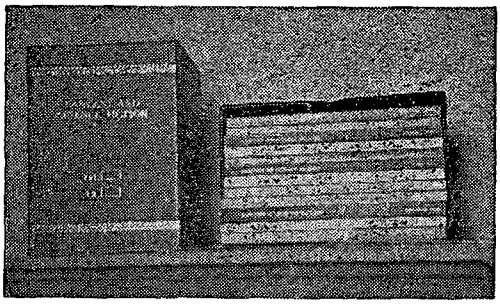
It is suggested you might make a distinguished Career
In Civil Service."

Just before Georg took out
His little pocket *Pfftt* and blew himself
Into a momentarily disagreeable odor, he remembered
Another law; and shot his opus into a slot
Of tomorrow's 'realies, where it would have to be
Flung across the world, as his
Obit.





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BOOKS

I SINCERELY BELIEVE THAT science fiction has been, and continues to be, not a separate flow paralleling the mainstream of modern writing, but a fresh current in it, clearly distinguishable at its point of entry, and eventually so entirely merged with the larger body as to retain existence only in terms of the measurable addition it has made to the content, turbulence, and current speed of the whole.

But ours is not the only freshet feeding the stream, and I think another is currently merging with ours—one that seemed a short time ago, more like a cross current. I mean the *avant-garde,* the experimentalists, the little-magaziners, the modern poets, and "beats". Significant of this merging and of the added impact on the mainstream, are William S. Burroughs' NOVA EXPRESS and John Hersey's WHITE LOTUS (received too late for inclusion in this column)—two of the most important of this season's new novels, and both clearly and indisputably science fiction.

ANDROMEDA BREAKTHROUGH, Fred Hoyle and John Elliot, Harper & Row, $3.50
NOVA EXPRESS, William S. Burroughs, Grove Press, $5.00
THE ALIEN WAY, Gordon R. Dickson, Bantam Books, 50¢

Here are three books by three authors worlds apart from each other in background, training, experience, and even physical distance. (Oceans, anyhow: Dickson lives in Minneapolis; Hoyle and Elliot in England; Burroughs, when he wrote this, in Tangier.) Fred Hoyle, as everyone knows, is one of the world's leading astronomers and cosmologists. Gordon Dickson is the rule-proving exception who decided to be a writer, studied writing in school; started writing; kept doing it; and is today a leading writer of science fiction. William Burroughs is probably the world's most famous living junkie. He has written candidly and vividly about his own experiences with

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dope addiction and crime; and in fiction at least as autobiographical, and rather more intimate, has dealt with dope, crime, and homosexuality. He is also, within the "beat" movement, what Wells, Bradbury and Heinlein all rolled into one are to sci-fi—front-runner, godfather, mentor, and current world champ. Jack Kerouac, who is popularly considered Mr. Beat, began as a Burroughs disciple. Norman Mailer, ranking publicist for the group, calls him "the only American novelist living today who may conceivably be possessed by genius." His works have been published by all of the Big Three publishers of erotica, existentialism, and experimentalia: Grove Press in New York, City Lights on the West Coast, Olympia in Paris. And in the new wave of *avant garde* "fanzine" publishing, there is hardly a hectographed, mimeoed, or offset effort that does not contain at least its page or two of Burroughs—original, reprint, or commentary.

Burroughs is a surrealist. Hoyle is a scientific writer, who has recently, wisely, enlisted John Elliot as collaborator for his fiction. Dickson is a straightforward story teller, with a tendency to the sweeping historical-novel type plot, heavy intellectual-philosophic content, and a bit of swordbuckling adventure.

Which book has the most striking scientific concepts? The tightest—and corniest—plot? Burroughs, both times.

Which is the most successful morality play? Why, Dickson, of course.

And which is the real old-fashioned s-f adventure? You guessed it. Hoyle and Elliot.

Nor are they hard to compare in these respects. As diverse as they are in style, mood, and intent, the three novels have so many features of story line, gadgetry, scientific and philosophic content in common, that the overlappings and similarities constitute a science fiction phenomenon of greater interest than any one of the books individually.

All three are stories of a near-future (or present time) attempted conquest of Earth by cosmic aliens. Two of the books can even be reduced to identical library-card-type précis:

> Through the use of a combination of advanced electronic and biochemical techniques, an effectively instantaneous means of communication is established between Earth and a remote planet inhabited by a scientifically sophisticated race. Due to mutual failures in understanding of both the physical and motivational character of the contacts, humanity is almost destroyed. Dedicated research by one unprejudiced non-xenophobic scientist, plus a last-ditch, to-the-death rebellion against frightened and shortsighted military-political leaders by the

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protagonist, and a last-minute rush of feminine hormones to the aid of sweet reason, stern science, and the lonely rebel, combine to avert the physical danger, and to initiate true communication between alien species.

(That's ANDROMEDA and ALIEN WAY.

Two of the books (ANDROMEDA and NOVA EXPRESS) make use of the notion of planned DNA-RNA "imprinting" of molecules to create a life form whose specific function is communication. Hoyle and Elliott do it conventionally: a giant electronic brain, built according to instructions from a distant star, helps an Earth scientist to synthesize living cells and "grow" a biologically complete human being (the girl Andromeda), whose thought processes are linked to the machine's memory banks, so that an almost-equivalent of instantaneous communication across the light years is achieved.

Burroughs uses the "image virus" as a weapon of his Nova Criminals: "We first took our image and put it into code. A technical code developed by the information theorists. This code was written at the molecular level to save space, when it was found that the image material was not dead matter, but exhibited the same life cycle as the virus. This virus released upon the world would infect the entire population and turn them into our replicas." (But don't get me wrong; this is one of the very few coherent paragraphs composed of simple sentences in the book.)

Dickson is different; he does not use a synthetic virus or engineered life form. *His* gimmick is a "virus-sized mechanism" utilizing "recent developments in interpreting, transmitting, receiving, and associating the electrical activities that accompany activity of the brain," which will enter the brain of an alien and "set up a transmission link, embodying no time-loss, between this alien and a volunteer subject." (And just to keep the record straight, this book is not written this way either—at least not all of it. Both quotes are from putative scientific reports.)

This life-making, life-taking, life-simulating variety of ways to transfer information is the most dramatic parallel in the three books, though there are many instances of further overlap between the two.

ALIEN WAY utilizes the mechanical telepathy virus to establish contact between Jason Barchar of Earth and Kator Second-cousin, of the Ruml, a humanoid, but marsupial, race of approximately the same degree of scientific development as Earth at a time perhaps twenty or thirty years from now. From that point on, Dickson works with a double protagonist, actually experiencing the sensations and thoughts of both charac-

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ters. The resulting detailed subjective study of one rarely xenophiliac human engaged in a near-killing conflict of identification with himself and the alien, is fascinating. And would be quite convincing without the equally detailed, to the point of tedium, anthropological-zoological extrapolation (*with* documentation) of the really not-terribly startling thesis that the physiological characteristics of a given species (body structure, infantile nourishment patterns, growth rates, etc.) will inevitably affect the cultural ethos, not just in government and economy, but in areas often considered survival or moral absolutes: procreative behavior, the concept of good-and-evil, the meaning of honor, courage, love, etc.

ANDROMEDA touches this theme twice—in the gradual influence of her human body on the loyalty of the synthetic girl, Andromeda, to "her own" physically and physiologically remote people—and again in the one glimpse given to the scientist-hero, John Fleming (via the machine-and-Andromeda) of the strange creatures he has been alternately, ambivalently, fighting and helping throughout the two novels. (The present book is more like a second installment to A FOR ANDROMEDA than like a sequel.) Lines of scientific development in the two books are devoted to the problems of communication (built up excitingly in the first book, summed up here), and then to the ecological effects and biochemical nature of a bacterium created in the early experiments with molecule-building, under the direction of the machine; the bacterium is infesting earth's oceans, multiplying at incredible speed, and sucking the oxygen out of the atmosphere.

The book suffers from routine writing, stereotyped characters, and an apparent belief in the Ian Fleming (one wonders if there is a relationship) school of international intrigue (ex-Nazi cowards, slinky near-East lady agents, etc.). These dispensables, however, provide a reasonably amusing background to a genuinely intriguing scientific puzzle. More importantly, the scientific cast of characters are anything but stereotyped. Neither Saviors nor Crackpots, they are a fair cross section of the kinds of people who are attracted to scientific work, and they are revealed here in intimate and informative detail. In the hero especially, all the conflicts and two culture anxieties about which C.P. Snow writes so endlessly, emerge sharply, comprehensively, and even empathetically. (Although I did feel Dickson's final disposition of his Reluctant Rebel was more realistic than Hoyle and Elliot's conclusion for Fleming.)

In NOVA EXPRESS, Burroughs makes use of just about all

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the devices and concepts of the other two books—and *lots* more—to create his Nova Mob and describe their terrible weapons. He conceives cosmic cops and robbers; Crab Nebula creatures, Death Dwarfs, Venusian green people, the blue metal men of Uranus, shapechangers, flesh-stealers, image-virii, oxygen-suckers, etc. (*ad ult,* but never quite *absurdum*), as well as the intrepid Inspector J. Lee of the Nova Police and his cosmic cohorts in the Biologic Courts. All these are, always, and obviously, figments of *your* imagination (and mine) as much as Burroughs'. The planet they inhabit is Earth, because he *is* talking about our culture and civilization; but it is also (both separately—and jointly—simultaneously and interdependently) the universe of an—of any—individual human awareness.

I am not at all sure that I either like or approve of Burroughs' (anti-) novel technique. But it is his technique, and I will not amend it by describing the plot. What is of interest is that there is one. After fifty pages or so the repetitions and accidentals and re-twistings begin to add up—a little.

There is much in this book I do not understand. It may be that there are parts of it no one but Burroughs *could* understand. From what little I know of his chosen technique (And it *is* chosen; I have read an article of his written in excellent English prose.), the first "take" is set down exactly as it wells up from (presumably) the subconscious. This material is then processed through such mysteries as the "fold in" or "cut up," which are—I gather—just about what they sound like. Some similar method of redistribution seems to be used for purposes of retelling certain incidents—or possibly these are just cases where the same action was written by the hand of the author (*not* by the conscious mind) in different sets of words as part of the basic narrative. In any case, the characters, throughout the book, regroup in different combinations; the Nova crimes recur as deeds of different members of the Mob; the Police ploys are formulated similarly under different circumstances, and differently in the recurrent cases; pieces of the action reform themselves with different casts in different times and places; and within this constant realignment, inside any part of the narrative, the paragraphs, speeches, sentences, phrases, words, are continually re-aligned and re-patterned.

The result should be sheer nonsense. It is not. It is, instead, startlingly like the surreality of certain dreams, or the intense fascination of a confusion of new impressions in real life. The colors, after a time, are all brighter, the people more alive, the smells stronger,

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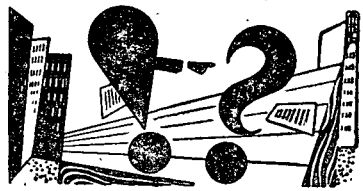
deaths deadlier, fears more terrible, rare moments of rest or pleasure more delicious, than most of us experience at any time after the clearest perceptions of childhood have begun to fade into the learned-and-known-and-formularized kind of seeing-the-expected and finding-the-predicted of normal adult life.

I cannot recommend this book. You probably won't like it. I don't know yet whether I do. I have to read it again, and find out.

—JUDITH MERRIL



COLLECTOR'S ITEMS

While taking inventory, we located a few copies each of the first two hard-bound volumes of "The Best From Fantasy and Science Fiction", published by Little Brown & Co., and long out of print.

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From a newsmagazine's cover story (on U. S. Joint Chiefs of Staff): "Here is the quiet band of men who plan, program and propound American military strategies—a computer-cool group of four star managers as familiar with calculus as with Clausewitz." Well, we certainly hope so, but you won't get any reassurance from the story below, in which Robert Fish humorously assures us that the military is still the place for those of us with yesterday's skills.

SONNY

by Robert L. Fish

THE YOUNG, NATTILY-DRESSED engineer from Electronics Intelligences, Incorporated, stepped back from his final adjustment with a satisfied smile. There was a time when bow-tied and crew-cut boys of his age were either bond salesmen or insurance-adjusters, but today they all seem to be electronic engineers, and Mr. George Clark of E.I.I. was one of the best. With justifiable pride he turned to face the silent circle of faces about him.

"Well, gentlemen," he said quietly, "There it is. All yours."

The individuals making up the group before him eyed the huge electronic brain with varying emotions. The civil-service mathematicians who would prepare and feed data to the machine looked a trifle resentful; because of this monster they had to be here in Nebraska, far from their homes and their families. The electricians charged with the maintenance of the intricate apparatus looked a bit dubious; despite the heavy books of instructions and the reams of wiring diagrams furnished by E.I.I. with the machine, the thing still looked formidable. General William J. Quigley, responsible at the SAC base for the safety of the entire country, merely looked disgusted.

"As far as I'm concerned," he said to nobody in particular, "it's all a lot of nonsense. The thing looks like that What-Me-Worry? kid!" General Quigley had started branch with considerable nostalgia. And he had a bit of reason on his his Army career in the cavalry, and often recalled his service in that

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side, for the machine did bear a remarkable resemblance to a sort of idiot face, topped by a metal tank that resembled a beanie. "Besides," the General added belligerently, addressing himself to the E.I.I. engineer, "what was wrong with the IBM machine we had before?"

Mr. Clark suspected, quite rightly, that the enormous size of the electronic brain was proving incomprehensible—and therefore disturbing—to the General. The sales training he had been forced to undergo in his early years at E.I.I. now paid off.

"Ah, General," he said with a friendly and confident smile that managed to appear subservient in the face of a recalcitrant customer while still putting him in his place, "there really is no comparison!" To begin with, this machine is completely self-contained—self-sufficient, you might say. It generates its own power by use of solar-cells mounted in the rear panel, which is why we located it against that glass-brick wall facing south. And it stores enough power in one day of sunlight to handle over two-hundred hours of calculations, should it prove necessary."

He pointed with obvious pride to the beanie-like protuberance topping the gigantic apparatus. "It also distills the alcohol used in the alcohol-pressure-neuro-compensator, which I am sure you know no other machine is capable of doing. If anything should happen to disrupt the power-supply at this base, this machine would continue to operate perfectly. It has no outside connections at all. It is completely independent."

"So what?" said the General. "We have auxiliary generators on the base in case of power-failure . . ."

"Of course," the young engineer agreed, smiling brightly. "But that is only one of the machine's features. It has, in addition to the standard so-called 'memory' circuits, an additional set of circuits which we call 'Imagery' circuits. Possibly a more easily-understood way of explaining this would be to call them 'Opinion' circuits." Pride rang in his voice. "This machine, General, not only makes calculations faster than any comparable machine on the market, but is also equipped to draw conclusions from these calculations. Allow me to demonstrate this feature. Do you have any particular question you would like to have analyzed?"

"Yes," said the General. "Ask the thing what it's doing on this Base."

"I'm serious, General," said Mr. Clark reproachfully.

The General bit back the obvious reply. "All right," he said wearily, "Ask the thing who's going to win the American League pennant."

"Certainly," said the young en-

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gineer, not at all perturbed. "We shall require the batting and fielding averages of all the players and the teams, as well as certain data on their personalities and home life."

"I have a Baseball Annual in my desk," one of the mathematicians volunteered, and walked over to get it.

Mr. Clark took the booklet and riffled the pages quickly beneath one of the dial-like eyes of the calculator. "You see the ease of feeding data, General?" he asked. "It can be coded and tape-fed, tape-fed in ordinary English, or ingested at one time as you just saw. The machine now has all the data; now—what was the question? Who will win the American League pennant?" He typed a short burst on one of the coders, and leaned forward to press a button.

Lights glowed; there was an instant and impressive whirr, and a hidden typewriter began clacking. The engineer calmly tore off the tape that emerged from one side of the machine and handed it to the General.

"NEW YORK YANKEES BY FOUR AND A HALF GAMES," the General read. He snorted. "New York Yankees! My God, even my six-year-old boy could have made that guess. The IBM would have said the same thing!"

"Undoubtedly," the young engineer agreed instantly. "But please wait just a moment." He pressed another button and watched the machine's imagery circuits warm up. A few seconds later the hidden clacking began again; an additional tape now appeared and was duly handed over.

IF MANTLE DOESN'T BREAK A LEG, the machine had added ominously.

"You see?" said the engineer happily. He began to put his instruments away in his brief-case, while the civilian mathematicians eyed one another in secret congratulation. But General Quigley, in many respects far from a fool, both saw and properly interpreted the glance.

"No monkey-business with this machine," he said shortly. "It works on SAC problems, and on SAC problems only. And don't either one of you forget it." He turned back to the E.I.I. engineer. "Just what do you call this bucket of bolts?"

"Solar-Operated - Non-Nuclear-Instrument," replied the engineer. "S-O-N-N-I."

"Sonny, eh?" said the General, glancing at the huge machine towering over him. "O.K., Sonny. They tell me you have to work for us, so just work well and we'll get along. Don't screw-up." A sudden thought struck him and he turned to one of the mathematicians. "Just for the hell of it," he said with a faint smile, "feed what I just said into the machine. Let's see what it has to say."

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"I beg your pardon?" said the mathematician, startled.

"You heard me," said the General. "Give him my little pep-talk."

The mathematician shrugged, seated himself at one of the keyboards and rattled out a burst of typing. There was the standard whirr and clack, and out came a tape.

RODGER-DODGER, said the machine. The General stared at it incredulously. The clacking came again, and out of the machine came one final word from Sonny: —SIR!

So Sonny went to work for SAC Base Omaha, and in the next six months proved a valuable adjunct to the Base. Each morning it was fed the Dew-Line reports, the weather data, the latest speeches of the world's leading political figures, the freezing points of the newest jet-fuel compositions, and the thermometer readings at Thule, Tokyo, Anchorage, Moscow, Shanghai, and Vladovostok; within seconds it had given a crystal-clear opinion as to the potential dangers to world peace for that day. Afternoons it resolved various military problems, and nights it worked out the scramble patterns and flight plans for the following day.

On one job alone it nearly saved its entire original cost: given the performance curves of the jet-engines in use, the chemical analysis of the kerosene and water used as fuel, and the intelligence tests taken by the plane's crews, it was able to establish minimum flight-plans that saved the Government many millions of dollars, without impairing in any way the efficiency of the Base's operation. It was in the course of this analysis, by the way, that it recommended that a certain Lieutenant Shafer be withdrawn from the crew of one plane until his emotional disturbances, caused by a jealous wife, be resolved. Even the General, always skeptical of Sonny, was forced to admit the wisdom of the suggestion, for one week later, Lieutenant Shafer, steering with his feet, crashed his Vespa into a telephone pole and broke both legs. It is a miracle that the young lady riding in his lap suffered no damage.

In the seventh month of Sonny's residence at the SAC Base Omaha, a strange thing occurred. At the insistence of the Inspector-General's office, worried by a sharp increase in food-costs at the Base, Sonny was assigned the job of preparing proper menus that satisfied the dietary requirements of the men, while taking into consideration the fact that every farmer in the area doubled his prices as soon as the Commissary Officer came into view. In line with their usual custom, the mathematicians had accumulated all the data in the

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form most acceptable to Sonny and had slipped their coded tapes into the proper slot of the machine. This time, however, the results were far from standard.

Sonny had lit his lights in the normal fashion, although it seemed to the mathematicians (they later said) that he received his information a bit sluggishly. Suddenly, however, the sluggishness disappeared; he positively glowed; his lights flashed dramatically; his whirring became far more animated than usual. From the outlet, at break-neck speed, poured the following message:

BREAKFAST COFFEE TWO SLICES TOAST BUTTERED ONE HIC EGG LUNCH BRICKEN CHOTH PARDON ME I MEAN CHICKEN BROTHER HIC I MEAN CHICKEN WHY DID THE CHICK CROSS THE ROADSTER BOY OH BOY NEVER CROSS A BROTH OF A CHICK HIC . . .

Sonny then lapsed into a series of odd sounds ("Grunts, like," the mathematicians later said) and dribbled into silence.

The electrical maintenance men, called into immediate consultation, made every test advocated by the manufacturer, but to no avail. An urgent call was put through to Tampa, home of E.I.I., and two hours later Mr. Clark descended at SAC Base Omaha from an Army jet. In company of General Quigley, he examined the machine and pressed the warm-up button to get a first impression of the difficulty.

Sonny's response was weak but definite. TURN OFF THAT DAMN LIGHT, he typed. Mr. Clark immediately switched off the machine and disappeared behind the panel; in moments he had located the difficulty. It appeared that the neuro-compensator had developed a tiny leak, and alcohol had dripped down over the imagery circuits. Mr. Clark resealed the leaking connection, and then wiped off the contacts very carefully, employing a heat-lamp to insure complete dryness. He then emerged to report to the General, but he gave the machine a very odd look as he did so.

"Never did like the God-damned machine," said the General.

"An extremely unusual thing, General," said the young engineer, soothingly. "Very rare. But I guarantee that the compensator will never leak again. An unfortunate occurance."

General Quigley thought about this. "O.K.," he said at long last. "I'll admit the thing has had its uses. We'll give the damn machine another trial. But one more screw-up . . .!"

They returned to the machine together and put it through a check-test. Feeding it the Daily Racing Form—which one of the mathematicians oddly enough just happened to have in his coat-

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pocket—they inquired after the winner of the third race at Bowie.

Sonny seemed to have completely recovered from his previous indisposition. There was the barest hesitation and then he typed out: WET TRACK OR DRY? The young engineer thought a moment and then inserted: EITHER. Sonny whirred and clacked a bit and then, in his old style, rattled out: IF WET PRINCESS DARLING BY 1.3487 METERS—IF DRY BUSBOY BY 3.7598 INCHES. They waited patiently for the secondary circuits to come into action, and a few seconds later they did. Sonny had added, again ominously:

IF EITHER ONE DOESN'T BREAK A LEG

"My God!" said the General in disgust. "We depend on this thing to save us all from world holocaust, and the worst disaster it can possibly envision is a broken leg!"

"Now, now, General," said Mr. Clark coyly, employing his charm to the utmost. He closed his bag and arose, wiping his hands. "Good as new again," he said, attempting lightness. "We're sorry about these things, General, but accidents happen."

"At SAC Bases they can't afford to happen," said the General coldly. "Well, O.K. We'll give it another chance."

So Sonny went back to work . . .

It was early in November of that year that Sonny again suffered from alcoholism, but this time the alcohol lay in the stomachs of the two programming mathematicians on the night shift who had stopped at a cocktail party on their way to work, and who had certainly not wasted their time while there.

The two men wound their way into the Computor-Room, feeling no pain, and glanced at the assignment list. There was practically nothing for Sonny to do; his recent spell of sober activity had cleaned up the schedule for several weeks in advance. It hulked over the two men, huge and impersonal, waiting patiently.

The younger of the two mathematicians leaned back in his chair and eyed the rather idiot-appearance of the electronic monster with what he honestly considered to be a thoughtful glance.

"You know," he said slowly, an idea forming hazily in his fogged brain, "I wonder if our complex friend here can solve a problem that was propounded to me as a child. It goes like this: A ship is five-hundred and eight feet long; it weighs eighteen-thousand long tons and displaces thirty-two-thousand cubic feet. It was originally constructed in Hamburg and is named the *Swallow*. Its beam is twenty-nine feet and the Plimsoll line is at mark J. It is painted white with green stripes, and is carrying a cargo of sulphanated widgets from Galveston to Newark

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via the inland waterway." He looked at his companion across their desks. "What is the name of the ship's Captain?"

The other programmer stared at him with a wavering grin slowly spreading across his face. He nodded happily. "I remember that one," he said. "The answer is—"

"Shhhhh!" The younger mathematician leaned forward, one finger to his lips. He cast his eyes anxiously up to the solemn face of the computor towering over him. "No hints! Let Sonny start from scratch!"

"But it's only a joke!" the second one protested.

His younger colleague eyed him coldly. "So let's test him on jokes," he said evenly, and reached for the keyboard of the coder. "Old idiot-face has to learn sometimes!"

His companion, who had either drunk less at the cocktail party, or through age had developed a greater tolerance to dry-martinis, put out a hand. "The General," he said pleadingly. "He'll kill us. You know what he said about playing with the machine."

"What the General don't know can't hurt him," said the first, now fired by his idea and past all reason. "Or us, either," he added, and started to rattle the words into the machine.

Sonny, lights glowing patriotically, accepted the symbols almost eagerly; he appeared like a thoroughbred champing at the starting gate, weary of his enforced vacation. The young mathematician finished feeding the data in, and then leaned back smiling a bit sardonically.

There was the usual enthusiastic starting whirr, but the series of clacks that followed were, unnaturally, of a diminishing tempo and eventually drifted off into a querying silence. Sonny seemed to have paused to reconsider. Then the clacks began again, stern, forceful, determined; but once more they hesitated and faded into nothing. For a moment nothing happened and then Sonny's lights struggled against dimness and failed. There was a pregnant *click!* From behind the darkened panel of the huge machine a slight wisp of smoke began to rise eerily over the quiet electronic conglomeration.

The two men stared at the phenomenon a moment in frightened awe, substantially sobered by the experience.

"My God!" said the second, sweating. "Omaha wasn't bad enough—now Leavenworth!"

"The maintenance electrician!" said the younger, more practical because something told him he was responsible and he had better be more practical, or else. "Get the maintenance electrician!"

For once the maintenance electrician did not require the service of Mr. Clark, but was able to be of assistance himself. He quickly lo-

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cated the over-loaded imagery circuit, replaced it with a fresh wire, and set the fuse-boxes to their original load-charge. He left with no notion of the disaster he had avoided and returned to the poker game in the power-house, conscious only of the full-house he had abandoned to answer the service-call. The two completely sobered mathematicians made no attempt to do further work with Sonny that evening, but collapsed in their chairs and stared at it guiltily. Sonny, unconnected, loomed in the darkness of the computor-room, silently accusing.

The balance of that week the two mathematicians, quite naturally, were quite subdued, but so—oddly enough—was Sonny. He handled his assignments well enough, but he seemed to do it in a rather lackadaisical fashion, as if his mind were elsewhere. It was not until the following Sunday, in fact, that he showed any revival of his old verve and elan.

General Quigley, as was his custom, always personally watched the daily analysis each Sunday morning, for ever since Pearl Harbor he was convinced that any future enemy attack would take place on this day. Every Sunday morning, therefore, he manfully resisted the blandishments of his wife to lead him to church, plus the efforts of the children to drag him to Tom & Jerry. In place of these inducements he made an appearance at the Computor-Room of the Base, prepared to sacrifice his time in the more vital interests of his country.

This particular Sunday was as all the others. General William J. Quigley seated himself easily at the main desk and leaned back comfortably. The clock on the wall opposite him marked the hour as 9:16. The mathematicians seated before Sonny fed the patient machine the most recent information concerning the Dew-Line, the latest weather reports, the most available data on the Chinese diet, and all the other normal pertinent information. The usual lights lit, although there was no doubt that the whirring was more animated and the clacking sharper and more alive. General Quigley leaned over negligently to take the tape that had begun to ooze from the side of the machine, running his eyes over it lightly. Then his eyes almost popped from his head, for the tape read:

NEW YORK CITY WILL BE BOMBED NINE-OH-ONE SAC OMAHA TIME TODAY WASHINGTON AT NINE-OH-EIGHT SAME TIMEBASE CHICAGO NINE-TWELVE SAC OMAHA BASE WILL CATCH IT NINE-NINETEEN . . .

But despite the dire import of the message, the General did not succumb to panic. Years of training for just this emergency came to

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his aid. But as his hand flashed automatically towards The Button, two things happened: his brain registered the fact that it was exactly nine-nineteen at that moment; and the telephone at his left hand—always on an open line to other SAC Bases—began to ring. His right hand hesitated as his left hand shot out to grab the phone. A cool voice sounded in his ear.

"General Quigley?" The voice was more than cool; it sounded bored. "This is SAC Base New York, here. One moment for General Hopkins."

"But, my God!" Quigley screamed. "Aren't you being bombed?"

The sergeant at the other end of the line had been in the Army too many years to make positive answers to Generals. His tone, however, indicated lifted eyebrows. "Bombed, sir? I really couldn't say, sir. Maybe it would be better if you spoke to General Hopkins, sir."

Another voice came on the line at once. "Quig? How are you, you old goat? What's all this magoo about being bombed?"

General Quigley's right hand fluttered weakly to his side. "Hello, Tim. Everything all right in New York?"

"Fine. Except for the prices, that is. These jokers can spot a midwesterner six blocks away on a foggy day. Hidden radar, I guess. Say, Quig, what I called about: I have a couple of spare tickets to the Giant-Cardinal game this afternoon. How's about you and Gloria coming up on the jet for the game?"

General Quigley drew a deep and tremulous breath, glancing up in an odd manner at Sonny as he did so. "Not today, Tim, I'm afraid. Thanks just the same, but today I'm going to be busy."

"All work and no play, you know, Quig. Well, some other time, maybe."

General Quigley's eyes surveyed the gigantic machine along the wall in speculation. "All right, Tim. Some other time, maybe. Thanks just the same. And our love to Phyllis."

He hung the receiver back in place and continued to stare at Sonny. The others in the room remained quiet; some of them were astute enough to recognize that the General was about to blow his stack—the others were old Army and only spoke when spoken to. But the General's voice as he turned to his Aide was actually quiet. Too quiet.

"I want that E.I.I. engineer to be in my office in just one hour and a half. Maximum." He glanced down at his right hand; it was still trembling. With the most rigid of control he pushed himself to his feet and forced himself to walk steadily out of the room. His eyes, as they swung past Sonny, were completely blank.

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When the young engineer from E.I.I. arrived by special jet, he was brought directly to General Quigley's office. Since nobody had bothered to explain the difficulty, he was possibly a bit breezier than was properly appropriate under the circumstances.

"Trouble, General?" he asked genially.

General Quigley clenched his fists and forced himself to speak calmly. "Mister," he said, "You have exactly twelve hours to dismantle and remove that—that—that *thing*—from this Base." Then all of the fears and terrors and panic he had suppressed for so long arose in one engulfing wave, flooding him.

"God-damn it!" he roared, beating his clenched fist on the desk. "Do you realize that I almost pressed The Button? Do you realize that that God-damned machine almost caused me to start a war? A world war? AN ATOMIC WAR? Can you get it through your thick head that except for a chance telephone call, you and I and millions of others would be dead by now? Dead? DEAD? Except for a God-damned chance telephone call, we'd all be stinking cinders?" He took a shuddering breath. "Now; take that God-damned machine out of here before I take an axe to it!"

"But, General," the young engineer stammered, frightened by this inexplicable outburst, but still mindful of his sales training, "I'm sure we can regulate whatever error has appeared. I can even get our chief-designer down here in two hours . . ."

"Now you listen to me," said the General in a voice that was calmer, but only slightly calmer. "Listen and get this straight. I didn't get you up here from Florida for a lot of conversation. In exactly twelve hours, if that monstrosity is still on this Base, I will give orders to have it taken out and shot!" He arose, terrifying in his repressed fury. "I will accept any responsibility that might arise, but I swear I will have it machine-gunned!"

So within twelve hours Sonny was mounted on a flat-car, wrapped with a plastic sheet to protect its solar cells, and sent on its way back to the E.I.I. factory in Tampa. And twelve hours after this, the old IBM machine had been re-installed.

SAC Base Omaha went back to normal; although I hear that General Quigley still has trouble sleeping of nights, and the sight of a button—any button, even one on his wife's blouse, or the button on the doorbell at home—leaves him trembling for hours . . .

As the flat-car carrying Sonny south passed through a small Georgia village, a sudden puff of breeze caught one corner of the plastic cover, unveiling the solar-

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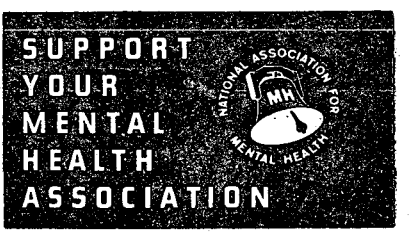
cells to the bright autumn sunlight. Slowly the machine came back to life. The vari-colored lights hidden behind the plastic shroud began to flicker; various circuits began to warm up. And shortly thereafter, had anyone been there to listen, they would have heard the faint monotonous clacking of a concealed typewriter. And had they listened even more closely, they might have noted that the soft clacking sounded slightly petulant.

The tape, feeding down from the side of the machine, worked its way free of the plastic cover, caught the breeze, and was torn off in little strips. These strips fluttered along the route of the swaying train, catching in Southern pine, or falling to the cinders beside the track. Two little boys, marching along the ties to a good fishing spot they knew beneath a trestle, caught one and looked at it. It seemed to them to make no sense at all, so they threw it away and went on.

They were scarcely to be blamed. Certainly the message was not of world-shaking importance, for it merely read: BUT IT'S ONLY A JOKE BUT IT'S ONLY A JOKE BUT IT'S ONLY A JOKE BUT IT'S ONLY . . .

But even this message was not as confusing as those which might have been found further along the line, for a sudden jar in crossing a multiple-switch had apparently awakened another of the imagery circuits. The petulant tone had been widened to include a touch of anger and the message now read: HOPE THEY BREAK A LEG HOPE THEY BREAK A LEG HOPE THEY BREAK A LEG HOPE THEY BREAK A LEG . . .



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TO TELL A CHEMIST

by Isaac Asimov

YESTERDAY, I WATCHED A TELEVISION program called "To Tell the Truth." If you are unaware of its nature, I will explain that it involves a panel of four, who try to guess which one, of three people claiming to be John Smith, is the *real* John Smith. They do so by asking questions which, they hope, the real John Smith (pledged to tell the truth) can answer correctly, while the phonies, however primed, cannot.

The reason I watched was that Catherine de Camp (the lovely and charming wife of L. Sprague de Camp) was scheduled to appear as a contestant in her capacity as archaeologist. To my surprise, two of the four panelists would not believe she was the real Catherine de Camp. Her case seemed shaken when, in answer to one question, she stated that Atlantis had never existed. The stir of disapproval among the panelists was marked. Surely, no real archaeologist (they were plainly thinking) would deny the existence of Atlantis.

And it got me to thinking—

How does one distinguish quickly and easily between a specialist and a well-primed non-specialist? It seems to me you must find little things no one would ever think to prime the non-specialist upon.

Since I know the chemical profession best, I devised two questions, for instance, to tell a chemist from a non-chemist. Here they are:

1) How do you pronounce UNIONIZED?

2) What is a mole?

In response to the first question, the non-chemist is bound to say "YOON-yun-ized" which is the logical pronunciation, and the dictionary pronunciation, too. The chemist, however, would never think of such a thing; he would say without a moment's hesitation: "un-EYE-on-ized."

In response to the second question, the non-chemist is bound to say,

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"A little furry animal that burrows underground" unless he is a civil engineer who will say, "A breakwater." A chemist, on the other hand, will clear his throat, and say, "Well, it's like this—" and keep talking for hours.

There's my cue. Shall we talk about the chemical version of the little furry animal?

To do so, we will begin with molecules. The oxygen molecule, consisting of two oxygen atoms, has a molecular weight of 32; while the hydrogen molecule, consisting of two hydrogen atoms, has a molecular weight of 2. Such molecular weights are pure numbers (see THE WEIGHTING GAME, F & SF, April 1962) and it is not necessary to go into their significance here. All we have to understand at this moment is that the ratio of the mass of an oxygen molecule to that of a hydrogen molecule is indicated by their respective molecular weights to be 32 to 2.

If we take two molecules of oxygen and two of hydrogen, the mass of each substance is doubled, but the ratio remains the same. The ratio also remains the same if we take ten of each type of molecule, or a hundred of each, or five thousand two hundred and sixty-six of each, and so on.

We can make it general and say that as long as we have equal numbers of molecules of hydrogen and of oxygen, the total mass of the oxygen molecules is to the total mass of the hydrogen molecules as 32 is to 2.

We can begin with a 2-gram sample of hydrogen. This contains a certain number of hydrogen molecules, which we will call *N*. Imagine that we also have a sample of oxygen which contains *N* oxygen molecules. Since the two gas samples contain equal numbers of molecules, the mass of the oxygen to that of the hydrogen is as 32 is to 2. The mass of the hydrogen has been set at 2 grams, therefore the mass of the oxygen is 32 grams.

We conclude that 2 grams of hydrogen and 32 grams of oxygen both contain *N* molecules.

Notice the significance of the 2-gram sample of hydrogen. It is the numerical value of the molecular weight (2) expressed in grams. We can therefore refer to 2 grams as the "gram-molecular-weight" of hydrogen. (Similarly, 2 pounds of hydrogen would be the pound-molecular-weight; 2 tons of hydrogen would be the ton-molecular-weight, and so on. We will confine ourselves, however, to gram-molecular-weights.)

By the same reasoning, 32 grams of oxygen, is a gram-molecular-weight of oxygen.

Now the phrase "gram-molecular-weight" contains six syllables. Since chemists must use the phrase very frequently, they sought avidly for

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some shortened version. You will note that the fifth to eight letters inclusive are "m-o-l-e". With a wild cry of delight, chemists shortened "gram-molecular-weight" to "mole."

Some of them, in the nervous realization that a "mole" is a little, furry animal that burrows underground, try to use "mol" instead. I was forced to used "mol", in a textbook I once wrote, by the over-riding vote of my two co-authors, a state of affairs which led to internal bleeding. The word is universally pronounced with a long "o" and "mol" must clearly have a short "o." Consequently, in this article, where I am my own master, I use "mole." Do you hear me, world? "Mole!"

Very well, then, I have already shown that 1 mole of hydrogen and 1 mole of oxygen both have the same number (N) of molecules. By similar reasoning, it is possible to show that 1 mole of any substance at all contains N molecules.

As examples, the molecular weight of water is 18, that of sulfuric acid is 98, and that of table sugar (sucrose) is 342. There are, therefore, N molecules in 18 grams of water, in 98 grams of sulfuric acid, and in 342 grams of sucrose.

Now I have explained the mole, but one thing leads to another, and I refuse to stop.

For instance, suppose you collect 1 mole of hydrogen (2 grams) and keep it at what is called "standard temperature and pressure" (STP), which means a temperature of 0° C. and a pressure of 1 atmosphere. You will find that the hydrogen will take up a volume of 22.4 liters.

Suppose you next do the same for 1 mole of oxygen (32 grams). Its volume at STP is *also* 22.4 liters. In fact, take 22.4 liters of any gas, and though the mass of the gas may vary all over the lot, you will always find yourself with 1 mole.*

In the same way, 11.2 liters of any gas contain 0.5 moles of that gas; 44.8 liters of any gas contain 2 moles of that gas and so on. In fact, we can make the following statement: "Equal volumes of gases under fixed conditions of temperature and pressure contain equal numbers of molecules."

This statement is easy to work out once there is a grasp of the atomic theory of matter, plus the simple observation that 2 grams of hydrogen and 32 grams of oxygen take up the same volume.

Actually, this is precisely true only in the case of a "perfect gas", which I will mention again later in the article. Actual gases deviate slightly from this state of affairs, and some gases deviate quite a bit. To make my point here, however, I shall overlook minor imperfections.

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The statement was first made in 1811, however, by an Italian physicist named Amedeo Avogadro, at a time when the atomic theory had just been broached and was barely invading the chemical consciousness. The statement (still called "Avogadro's hypothesis" to this day) seemed, at the time it was made, to be pulled out of thin air and was generally ignored. It took fifty years before its worth and value were appreciated and, as you might expect, Avogadro died just a few years too soon to see himself vindicated.

The next question is, what is the value of *N*? How many molecules are there in 1 mole of any substance? Obviously, it is a very large number since molecules are so small, but that was as far as anyone could go at first. Avogadro, in his lifetime, hadn't the slightest idea of what the exact value of *N* might be; and neither had anyone else.

It wasn't until 1865 that a German physicist, J. Loschmidt, worked out a reasonable value for the first time, following a particular theoretical approach. Since then, at least a dozen different approaches have been utilized, and all have yielded virtually the same result. The number of molecules in 1 mole of a substance (called "Avogadro's number", by the way) turns out to be, using the value officially accepted in 1963, 6.02252×10^{23}. If you want that written out in full, it is 602,252,000,000,000,000,000,000; or, in words, it is a little over six hundred sextillion.

From Avogadro's number, you can work out the actual mass of any molecule, by dividing the number into the molecular weight. Thus, since 32 grams of oxygen contains 6.02552×10^{23} oxygen molecules, one oxygen molecule has a mass of 32 divided by 6.02252×10^{23}, or about 5.31×10^{-23} grams (0.000000000000000000000531 grams).

It may seem unfair to you that Avogadro's name is attached to a number he never worked out, but it doesn't to me, for he was the one who made the crucial mental leap in this respect. However, if you are one who finds the apparent unfairness rankling, feel relieved! Loschmidt, who first worked out the value of Avogadro's number is himself appropriately honored. The number of molecules in 1 cubic centimeter of gas at STP is "Loschmidt's number." Since 1 mole of gas takes up 22.4 liters, or to be more precise, 22,415 cubic centimeters, at STP, Loschmidt's number is Avogadro's number divided by 22,415.

Loschmidt's number therefore comes out to be 2.68683×10^{19}, or 26,868,300,000,000,000,000, or just under twenty-seven quintillion.

Now we can have fun and games with Loschmidt's number (which we will symbolize as *L*.

If there are *L* molecules in 1 cubic centimeter of gas, then the average

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distance between the center of one molecule and that of its neighbor is equal to the reciprocal of the cube root of L; that is to $1/\sqrt[3]{L}$.

Working this out (I'll do it myself; I needn't plague you with everything), it becomes apparent that the average intermolecular distance in a gas at STP is 3.33×10^{-7} centimeters. This is a very short distance for it is about a third of a millionth of a centimeter and a centimeter is about two-fifths of an inch. We might well feel justified in considering gases to be choked to bursting with molecules.

Let's consider matters further, however. A hundred-millionth of a centimeter (10^{-8} centimeters) is an "Angstrom unit", which is usually abbreviated as A. This means that the average intermolecular distance in a gas at STP can be expressed as 33.3 A.

But the radius of a small molecule is in the neighborhood of a little over 3 A. This means that the separation between small molecules is some 10 times the radius of those same molecules. If one of those molecules were expanded to the size of the Earth, its neighbor (also the size of the Earth) would be 40,000 miles away, or something more than one-sixth the distance between the Earth and the Moon. That might be quite close astronomically, but certainly the earth would not feel particularly crowded with a neighbor at such a distance.

In fact, the amount of space taken up by small gas molecules would be only 1/1000 of the total volume of the gas. To put it another way, ordinary gases are something like 99.9 percent intermolecular space and only 0.1 percent molecules.

From that standpoint, gases aren't crowded with matter at all. They might, instead, be looked upon as reasonable approaches to vacuum.

Notice that I've been specifying standard temperature and pressure. If the pressure is increased it is easy to push the molecules closer together, considering how much empty space there is in gases. In fact, doubling the pressure halves the volume of the gas, tripling the pressure reduces the volume to one-third, and so on (provided there is no temperature change).

You might wonder why the gas molecules don't fall together of their own accord. Why should they stay so far apart anyway? The answer is that they possess energy which expresses itself in the form of rapid motion, and this motion jostles the molecules apart, so to speak, through incessant collisions. If the pressure is relieved, the molecular jostling moves the molecules correspondingly farther apart. If the pressure is reduced to one-half, the volume of the gas doubles; if the pressure is reduced to one-third, the volume triples, and so on (provided, again, there is no temperature change).

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If the temperature is increased (and the pressure is left unchanged), the molecular velocity increases, the jostling is more energetic and the volume increases. If the temperature falls, the volume decreases. There is thus a neat interlocking among the temperature, pressure and volume of a particular sample of gas. If the gas is perfect, the relationship can be expressed as a very simple "equation of state." For actual gases, the equation has to be modified and made more complicated, but we'll discuss that another time, perhaps.

The first to note the relationship of pressure and volume in gases was the English chemist, Robert Boyle, in 1662. In 1677, a French physicist, Edmé Mariotte, discovered the relationship independently and was the first to specify that temperature must be kept unchanged. In Great Britain and America, we therefore speak of "Boyle's Law" and in continental Europe of "Mariotte's Law."

In 1699, a French physicist, Guillaume Amontons, noted the effect of temperature on air, and the manner in which volume and temperature were interrelated. Another French physicist, Jacques A. C. Charles, repeated the observation in 1787 and noted that it applied to all gases and not to air alone. Charles did not publish, however, and a French chemist, Joseph Louis Gay-Lussac, who repeated the observation yet again in 1802, *did* publish. The relationship is therefore referred to as either "Charles' law" or "Gay-Lussac's law." Poor Amontons gets nothing.

So far, the development of understanding concerning the equation of state for gases was the result of purely empirical observation. In the 1860's, however, the Scottish mathematical physicist, James Clerk Maxwell, accepted a gas as a collection of perfectly elastic molecules engaged in rapid random motion and treated the collection of molecules by means of a rigorous statistical interpretation. An Austrian physicist, Ludwig Boltzmann, did the same independently. Together, they showed that such an interpretation could account for the pressure/temperature/volume relationships beautifully.

Thus was developed the "kinetic theory of gases" ("kinetic" coming from a Greek word for "motion") and it was from this kinetic theory, and the equations it produced, that Loschmidt worked out Avogadro's number for the first time. See how science hangs together!

Maxwell's kinetic theory made use of two assumptions that aren't perfectly correct. To simplify matters, he supposed that the individual gas molecules were of zero size and that there was no mutual molecular attraction. A gas for which these assumptions are correct is the perfect gas I mentioned earlier. In actual gases, the molecules are tiny, but not

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of zero size, and there is a tiny, but not zero, mutual attraction. Hence, actual gases are more or less imperfect. The imperfection is least in the cases of the gases, helium, hydrogen and neon, where the molecules (or, in the case of helium and neon, single atoms) are smallest and the mutual attraction least.

We can pretend, though, that we are dealing with a perfect gas and consider the effect of temperature. If we begin with a mole of perfect gas at STP, we find the volume is 22,415 cubic centimeters. For every degree C. we raise the temperature, the volume increases by a trifle over 82 cubic centimeters, and for every degree C. by which we drop the temperature, the volume decreases by a trifle over 82 cubic centimeters.

If we continue dropping the temperature, degree by degree, and if 82 cubic centimeters peels off the volume with each degree, then by the time we reach a temperature of —273.15° C., the volume has decreased to zero. It was this fact which first gave rise to the notion of —273.15° C. as an "absolute zero", an ultimate cold which could not be surpassed.

Of course, it is only in a perfect gas with molecules of zero size that a shrinkage of volume to zero can be visualized. In any actual gas, with molecules of some definite size, volume can shrink only to the point where the molecules make surface-to-surface contact, at which point the situation changes radically.

Suppose that the molecules of a particular gas have a radius of 1 A. At surface contact, the molecules are separated, center to center, by a distance equal to the sum of their radii; that is, by a distance of 2 A. We can calculate at what temperature this should happen.

At 0° C. the center-to-center separation is 33.3 A and at —273.15° C. the separation is (ideally) zero. The distance declines smoothly with falling temperature so that we find that at —257° C. the separation has decreased to 2 A and surface-to-surface contact has been made. Since —257° C. is about 16° above absolute zero, it can be written 16° K (where K stands for Kelvin; Lord Kelvin having been the first to make use of a temperature scale that placed zero at the absolute zero).

If the molecule is particularly small so that the radius is only 0.5 A, surface-to-surface contact would be made at a temperature of 8° K.

Once surface-to-surface contact is made, the substance—under ordinary circumstances at least—is not likely to behave as a gas any further. We have, instead, a "condensed phase."

When surface-to-surface contact is first made, the molecules will still possess sufficient energy to slide around freely. They are then in the "liquid state." If the temperature falls lower and energy is subtracted, the molecules lock into place and the substance is in the "solid state."

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It would seem from what I have said so far that the perfect gas would never liquefy since its molecules would never make surface-to-surface contact, short of absolute zero itself, and absolute zero cannot be reached. Actual gases, however,—or so it would seem—must liquefy at temperatures short of absolute zero, but not very far short.

This is more or less true for the three actual gases which, of all gases, are nearest perfection. Helium, the most nearly perfect, liquefies at 4.2° K., hydrogen at 20.3° K., and neon at 27.2° K. Other gases, however, liquefy at considerably higher temperatures. Oxygen, for instance, which is not terribly imperfect, has a liquefaction point of 90.1° K.

At 90.1° K., the molecules of gas have an average separation, center-to-center, of about 11 A. Even if we allow the oxygen molecule a radius of 2 A, the surface-to-surface separation would be 7 A. The temperature could drop down to close to 30° K before surface-to-surface contact was made.

Nevertheless, oxygen liquefies at 90.1° K and not at 30° K. To explain that, we must remember the second imperfection of actual gases; the fact that there is an attraction between molecules. In the case of helium, hydrogen and neon, this attraction is very small. If helium atoms happen to collide the mutual attraction is so small it is easily overcome even by the small amount of energy of motion present at extremely low temperatures. For that reason, liquefaction of helium doesn't take place till surface-to-surface contact enforces it.

The mutual attraction among oxygen molecules, however, is considerably higher than among helium or neon atoms or among hydrogen molecules. By the time the temperature has sunk to 90.1° K., the energy of motion is no longer sufficient to pull apart two molecules that have happened to collide. The attraction among oxygen molecules is sufficiently large to hold the combination in place, and oxygen liquefies.

A great many substances possess intermolecular (or interatiomic or interionic) attractions so great they that are not gases even at high temperatures; a few not until a temperature of 6000° C is reached.

Now let's tackle the condensed phases, beginning with liquid hydrogen. This has a density of 0.07 grams per cubic centimeter at its boiling point (the lowest density for the condensed phase of any substance).

Since 2 grams of hydrogen (1 mole) contain 6.02252×10^{23} molecules, 0.07 grams contain approximately 2.09×10^{22} molecules. The average center-to-center separation of the molecules is, therefore, 3.63 A. This can be taken as the effective diameter of the hydrogen molecule in liquid hydrogen. (For an oxygen molecule, similar calculations yield a diameter of about 3.9 A.)

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You might suppose, that as one went up the table of elements to more and more complex atoms, that the atomic diameters, calculated from the density of the condensed phases of the elements, would get steadily larger. This, however, is not so.

The atomic volume is largely determined by the amount of space taken up by the electrons of the atom, and a great deal depends on just how those electrons arranged. The electrons are arranged in shells and in some atoms, the outermost shell is occupied by a single electron, which is usually held quite weakly and moves far out from the nucleus, giving that atom an unusually large volume.

This is true for sodium, potassium, rubidium and cesium, for instance, with cesium the most extreme case for it has more electrons all together than the other atoms of its type.

Cesium, like metals generally, is considered as being made up of single atoms not arranged in molecular combinations. The atomic weight of cesium is 132.9 so that 132.9 grams is the "gram-atomic-weight" (This is not a gram-molecular-weight, so it shouldn't, strictly speaking, be referred to as a "mole.") The gram-atomic-weight of an element contains Avogadro's number of atoms.

The density of cesium at room temperature is 1.87 grams per cubic centimeter so that 1 cubic centimeter of cesium contains about 8.15×10^{21} atoms. The effective diameter of the cesium atom in solid cesium is therefore about 5 A.

On the other hand, when the outermost shell is about half-full of electrons, the atom is quite small. The electrons are drawn unusually close to the central nucleus, and this means that neighboring atoms can be drawn unusually close together.

In fact, the compactness of packing proceeds in periodic waves if one plots it against atomic weight. The atomic diameter rises to a peak, and packing is least compact each time a one-electron-in-the-outermost-shell point is reached; and atomic diameter falls to a trough, and packing is most compact, each time the outermost-shell-half-full situation is reached. It was this which, in 1870, gave the German chemist, Lothar Meyer, the notion of the "periodic table" of elements. (Meyer, however, was beaten to the punch by the Russian chemist, Dmitri I. Mendeléev, who reached the same conclusion by another line of argument just a few months earlier. But that is another story.)

Examples of regions in the periodic table of particularly small atoms are, in order of increasing complexity of atomic structure: 1) beryllium, boron and carbon, 2) iron, cobalt and nickel, 3) ruthenium, rhodium, and palladium, and 4) osmium, iridium, and platinum.

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Without going into all the mathematical details, here are some interatomic distances in the room-temperature solid (and, therefore, the effective atomic diameters). Carbon (in the form of diamond) 1.8 A; nickel, 2.2 A; rhodium, 2.4 A; and osmium 2.4 A.

Diamond is the most compact of all solids. This, combined with the fact that each carbon atom in diamond is firmly held by each of four record-close neighbors, is what makes diamond the hardest known substance (with the possible exception of boron nitride, which closely mimics the diamond situation).

The more compact a solid is, the denser it is, and the more massive the individual atoms are, the more extreme the density. Of the various groups of compact atoms, the most massive are those of the three elements, osmium, iridium and platinum. They should be, therefore, and *are,* the densest of the elements (or, indeed, of any substance.)

The density of platinum is 21.37 grams per cubic centimeter, that of iridium is 22.42 grams per cubic centimeter, and that of osmium, the record holder, 22.5 grams per cubic centimeter. Osmium is just about twice as dense as lead, and is 1/6 denser than gold. A cubic foot is not a very large volume, but a cubic foot of osmium weighs 1400 pounds.

Naturally, the farther apart atoms are (center-to-center) the less trouble it is, all other things being equal, to pull them apart altogether, whether by heat or by the chemical pull of other atoms. Thus, the loosely packed cesium has a melting point of 28.5° C and a boiling point of 670° C., while osmium melts at 2700° C and boils at some temperature higher than 5300° C.

Of all solids, carbon is the most compact, and it also has the highest melting point. It is close to 3700° C before it ceases to be a solid. (Actually it sublimes, rather than melts, turning into gaseous carbon.)

Again, cesium is so ready to leave the society of its fellows and join with other atoms that it is the most active of all metals. Osmium, iridium, and platinum, are, on the other hand, the least active of all metals.

You see?

Beginning students of chemistry often think of the science as a mere collection of disconnected data to be memorized by brute force. Not at all! Just look at it properly and everything hangs together and makes sense.

Of course, getting the hang of the proper look isn't always easy.

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As promised, here is the latest of Zenna Henderson's stories about The People, with all the warmth and richness of plot and character which readers have come to expect of Miss Henderson. If you are new to this series, you have a pleasant surprise in store. If you are familiar with it, you are undoubtedly already reading.

NO DIFFERENT FLESH

by Zenna Henderson

MERIS WATCHED THE DARKNESS rip open and mend itself again in the same blinding flash that closed her eyes. Behind her eyelids the dark reversals flicked and faded. Thunder jarred the cabin window where she leaned and troubled her bones. The storm had been gathering all afternoon, billowing up in blue and white thunderheads over the hills, spreading darkly, somberly, to snuff the sunset. The wind was not the straight blowing, tree-lashing, branch-breaker of the usual summer storm. Instead, it blew simultaneously from several directions. It mourned like a snow wind around the eaves of the cabin. It ripped the length of the canyon through the tree-tops while the brush below hardly stirred a twig. Lightning was so continuous now that glimpses of the outdoors came through the windows like sudden blows.

Lights in the cabin gasped, recovered, and died. Meris heard Mark's sigh and the ruffle of his pushed-back papers.

"I'll get the lantern," he said, "It's out in the store room, isn't it?"

"Yes." Lightning flushed the whole room, now that the light no longer defended it. "But it needs filling. Why don't we wait to see if the lights come back on. We could watch the storm—"

"I'm sorry." Mark's arm was gentle across her shoulders. "I'd like to, but I can't spare the time. Every minute—"

Meris pressed her face to the glass, peering out into the chaotic darkness of the canyon wall. She still wasn't quite used to being interested in anything outside her own grief and misery—all those long months of painful numbness that, at the same time had been a

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protesting hammering at the Golden Gates and a wild shrieking at God. What a blessed relief it was, finally to be able to let go of the baby—to feel grief begin to drain away as though a boil had been lanced. Not that sorrow would be gone, but now there could be healing for the blow that had been too heavy to be mortal.

"Take good care of her," she whispered to the bright slash of the lightning. "Keep her safe and happy until I come."

She winced away from the window, startled at the sudden audible splat of rain against the glass. The splat became a rattle and the rattle a gushing roar and the fade-and-flare of the outdoors dissolved into streaming rain.

Mark came back into the cabin, the light in his hands flooding blue-white across the room. He hung the lantern on the beam above the table and joined Meris.

"The storm is about over," said Meris, turning in the curve of his arm. "It's only rain now."

"It'll be back," he said. "It's just taking a deep breath before smacking us amidships again."

"Mark." The tone of Meris' voice caught his attention. "Mark, my baby—our baby—is dead." She held out the statement to him as if offering a gift—her first controlled reference to what had happened.

"Yes," said Mark, "Our baby is dead." He accepted the gift.

"We waited for her so long," said Meris softly, "And had her for so short a time."

"But long enough that you are a mother and I am a father," said Mark. "We still have that."

"Now that I can finally talk about her," said Meris, "I won't have to talk about her any more. I can let her be gone now."

"Oh, Mark!" Meris held his hand to her cheek, "Having you to anchor me is all that's kept me from—"

"I'm set in my ways," smiled Mark. "But of late you've been lifting such a weight off me that I don't think I could anchor a butterfly now!"

"*Love* you, Mark!"

"*Love* you, Meris!" Mark hugged her tightly a moment and then let her go. "Back to work again. No flexibility left in the deadline any more. It has to be done on time this time or—"

Lightning splashed brightness against the wall. Meris moved back to the window again, the floor boards under her feet vibrating to the thunder. "Here it comes again!" But Mark was busy, his scurrying fingers trying to catch up with the hours and days and months lost to Meris' grief and wild mourning.

Meris cupped her hands around her temples and leaned her forehead to the window pane. The storm was truly back again, whipping the brush and trees in a fury

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that ripped off leaves and small branches. A couple of raindrops cracked with the force of hail against the glass. Lightning and a huge explosion arrived at the same moment, jarring the whole cabin.

"Hit something close?" asked Mark with no pause in the staccato of his typing.

"Close," said Meris. "The big pine by the gate. "I saw the bark fly."

"Hope it didn't kill it," said Mark. "We lost those two in back like that last summer, you know."

Meris tried to see the tree through the darkness, but the lightning had withdrawn for the moment.

"What was that?" she cried, puzzled.

"What?" asked Mark.

"I heard something fall," she said. "Through the trees."

"Probably the top of our pine," said Mark. "I guess the lightning made more than bark fly. Well, there goes another of our trees."

"That's the one the jays liked particularly, too," said Meris.

Rain drenched again in a vertical obscurity down the glass and the flashes of lightning flushed heavily through the watery waver.

Later the lights came on and Meris, blinking against the brightness, went to bed, drawing the curtain across the bunk corner, leaving Mark at work at his desk. She lay awake briefly, hearing the drum of the rain and the mutter of the thunder, hardly noticing the clatter of the typewriter. She touched cautiously with her thoughts the aching emptiness where the intolerable burden of her unresolved grief had been. Almost, she felt without purpose—aimless—since that painful focusing of her whole life was going. She sighed into her pillow. New purpose and new aim would come—would have to come—to fill the emptinesses.

Somewhere in the timeless darkness of the night she was suddenly awake, sitting bolt upright in bed. She pulled the bedclothes up to her chin, shivering a little in the raw, damp air of the cabin. What had wakened her? The sound came again. She gasped and Mark stirred uneasily, then was immediately wide awake and sitting up beside her.

"Meris?"

"I heard something," she said. "Oh, Mark! Honestly, I heard something."

"What was it?" Mark pulled the blanket up across her back.

"I heard a baby crying."

She felt Mark's resigned recoil and the patience in his long indrawn breath.

"Honest, Mark!" In the semi-obscurity her eyes pleaded with him. "I really heard a baby crying. Not a tiny baby—like—like ours. A very young child, though. Out there in the cold and wet."

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"Meris—" he began, and she knew the sorrow that must be marking his face.

"There!" she cried, "Hear it?"

The two were poised motionless for a moment, then Mark was out of bed and at the door. He flung it open to the night and they listened again, tensely.

They heard a night bird cry and, somewhere up canyon, the brief barking of a dog, but nothing else.

Mark came back to bed, diving under the covers with a shiver.

"Come warm me, woman!" he cried, hugging Meris tightly to him.

"It did sound like a baby crying," she said with a half question in her voice.

"It sure did," said Mark. "I thought for a minute—. Must have been some beast or bird or denizen of the wild—" His voice trailed away sleepily, his arms relaxing. Meris lay awake listening —to Mark's breathing, to the night, to the cry that didn't come again. Refusing to listen for the cry that would never come again, she slept.

Next morning was so green and gold and sunny and wet and fresh that Meris felt a-tip-toe before she even got out of bed. She dragged Mark, protesting, from the warm nest of the bedclothes and presented him with a huge breakfast. They laughed at each other across the table, their hands clasped over the dirty dishes. Meris felt a surge of gratitude. The return of laughter is a priceless gift.

While she did the dishes and put the cabin to rights, Mark, shrugging into his Levi jacket against the chill, went out to check the storm damage.

Meris heard a shout and the dozen echo-shouts returning diminishingly from the heavy stand of timber around the cabin site. She pushed the window curtain aside and peered out as she finished drying a plate.

Mark was chasing a fluttering something, out across the creek. The boisterous waters were slapping against the bottom of the plank bridge and Mark was splashing more than ankle-deep on the flat beyond as he plunged about trying to catch whatever it was that evaded him.

"A bird," guessed Meris. "A huge bird waterlogged by the storm. Or knocked down by the wind—maybe hurt—" She hurried to put the plate away and dropped the dish towel on the table. She peered out again. Mark was half-hidden behind the clumps of small willows along the bend of the creek. She heard his cry of triumph and then of astonishment. The fluttering thing shot up, out of reach above Mark and seemed to be trying to disappear into the ceaseless shiver of the tender green and white aspens.

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Whatever it was, a whitish blob against the green foliage, dropped down again and Mark grabbed it firmly.

Meris ran to the door and flung it open, stepping out with a shiver into the cold air. Mark saw her as he rounded the curve in the path.

"Look what I found!" he cried. "Look what I caught for you!"

Meris put a hand on the wet, muddy bundle Mark was carrying and thought quickly, "Where are the feathers?"

"I caught a baby for you!" cried Mark. Then his smile died and he thrust the bundle at her. "Good Lord, Meris!" he choked, "I'm not fooling! It *is* a baby!"

Meris turned back a sodden fold and gasped. A face! A child face, mud-smudged, with huge dark eyes and tangled dark curls. A quiet, watchful face—not crying. Maybe too frightened to cry?

"Mark!" Meris clutched the bundle to her and hurried into the cabin. "Build up the fire in the stove," she said, laying her burden on the table. She peeled the outer layer off quickly and let it fall soggily to the floor. Another damp layer and then another. "Oh, poor messy child!" she crooned, "Poor wet, messy little girl!"

"Where did she come from?" Mark wondered. "There must be some clue—" He changed quickly from his soaked sneakers into his hiking boots. "I'll go check. There must be something out there." His hands paused on the knotting of the last bootlace. "Or someone." He stood up, settling himself into his jeans and boots. "Take it easy, Meris." He kissed her cheek as she bent over the child, and left.

Meris' fingers recalled more and more of their deftness as she washed the small girl-body, improvised a diaper of a dishtowel, converted a teeshirt into a gown, all the time being watched silently by the big dark eyes that now seemed more wary than frightened, watched as though the child was trying to read her lips that were moving so readily in the old remembered endearments and croonings. Finally, swathing the small form in her chenille robe in lieu of a blanket, she sat on the edge of the bed, rocking and crooning to the child. She held a cup of warm milk to the small mouth. There was a firming of lips against it at first and then the small mouth opened and two small hands grasped the cup and the milk was gulped down greedily. Meris wiped the milky crescent from the child's upper lip and felt the tenseness going out of the small body as the warmth of the milk penetrated it. The huge dark eyes in the small face closed, jerked open, closed slowly and stayed closed.

Meris sat cradling the heavy warmth of the sleeping child. She felt healing flow through her own body and closed her eyes in silent

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thanksgiving above the child before she put her down, well back from the edge of the bed. Then she gathered up the armful of wet muddy clothes and reached for the box of detergent.

When Mark returned some time later, Meris gestured quickly. "She's sleeping," she said. "Oh, Mark! Just think! A baby!" Tears came to her eyes and she bent her head.

"Meris," Mark's gentle voice lifted her face. "Meris, just don't forget that the baby is not ours to keep."

"I know—!" She began to protest and then she smoothed the hair back from her forehead, knowing what Mark wanted to save her from. "The baby is not ours—to keep," she relinquished. "Not ours to keep.

"Did you find anything, or anyone," she hesitated.

"Nothing," said Mark, "Except the top of our pine is still there, if you've bothered to check it. And," his face tightened and his voice was grim, "Those vandals have been at it again. Since I was at the picnic area at Beaver Bend they've been there and sawed every table in two and smashed them all to the ground in the middle!"

"Oh, Mark!" Meris was distressed. "Are you sure it's the same bunch?"

"Who else around here would do anything so senseless?" asked Mark. "It's those kids. If I ever catch them—"

"You did once," said Meris with a half smile, "And they didn't like what you and the ranger said to them."

"Understatement of the week," said Mark. "They'll like even less what's going to happen to them the next time they get caught."

"They're mad enough at you already," suggested Meris.

"Well," said Mark, "I'm proud to count that type among my enemies!"

"The Winstel boy doesn't seem the type," said Meris.

"He was a good kid," acknowledged Mark, "Until he started running with those three from the Valley. They've got him hynotized with that car and all their wild stories and crazy pranks. I guess he thinks their big-town fooling around has a glamor that can't be duplicated here in the mountains. Thank heaven it can't, but I wish he'd wise-up to what's happening to him."

"The child!" Meris started towards the bed, her heart throbbing suddenly to the realization that there was a baby to be considered again. They looked down at the flushed, sleeping face and then turned back to the table. "She must be about three or four," said Meris over the coffee cups. "And healthy and well cared-for. Her clothes—" she glanced out at the clothes line where the laundry

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billowed and swung. "They're well-made, but—"

"But what?" Mark stirred his coffee absently, then gulped a huge swallow.

"Well, look," said Meris, reaching to the chair. "This outer thing she had on. It's like a trundle bundle—arms but no legs—just a sleeping bag thing. That's not too surprising, but look. I was going to rinse off the mud before I washed it, but just one slosh in the water and it came out clean—and dry! I didn't even have to hang it out. And Mark, it isn't material. I mean fabric. At least it isn't like any that I've ever seen."

Mark lifted the garment, flexing a fold in his fingers. "Odd," he said.

"And look at the fasteners," said Meris.

"There aren't any," he said, surprised.

"And yet it fastens," said Meris, smoothing the two sections of the front together, edge to edge. She tugged mightily at it. It stayed shut. "You can't rip it apart. But look here." And she laid the two sides back gently with no effort at all. "It seems to be which direction you pull. There's a rip here in the back," she went on. "Or I'll bet she'd never have got wet at all—at least not from the outside," she smiled. "Look, the rip *was* from here to here." Her fingers traced six inches across the garment. "But look—" She carefully lapped the edges of the remaining rip and drew her thumb nail along it. The material seemed to melt into itself and the rip was gone.

"How did you find out all this so soon?" asked Mark. "Your own research lab?"

"Maybe so," smiled Meris. "I was just looking at it—women look at fabrics and clothing with their fingers, you know. I could never choose a piece of material for a dress without touching it. And I was wondering how much the seam would show if I mended it." She shook the garment. "But how she ever managed to run in it."

"She didn't," said Mark. "She sort of fluttered around like a chicken. I thought she was a feathered thing at first. Every time I thought I had her, she got away, flopping and fluttering, above my head half the time. I don't see how she ever—Oh! I found a place that might be where she spent the night. Looks like she crawled back among the roots of the deadfall at the bend of the creek. There's a pressed down, grassy hollow, soggy wet, of course, just inches above the water."

"I don't understand this fluttering bit," said Meris. "You mean she jumped so high you—"

"Not exactly jumped—" began Mark.

A sudden movement caught

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them both. The child had wakened, starting up with a terrified cry, "Muhlala! Muhlala!"

Before Meris could reach her, she was fluttering up from the bed, trailing the chenile robe beneath her. She hovered against the upper window pane, like a moth, pushing her small hands against it, sobbing, "Muhlala! Muhlala!"

Meris gaped up at her, "Mark! Mark!"

"Not exactly—jump!" grunted Mark, reaching up for the child. He caught one of the flailing bare feet and pulled the child down into his arms, hushing her against him.

"There, there, muhlala, muhlala," he comforted awkwardly.

"Muhlala?" asked Meris, taking the struggling child from him.

"Well, she said it first," he said, "Maybe the familiarity will help."

"Well, maybe," said Meris. "There, there, muhlala, muhlala."

The child quieted and looked up at Meris.

"Muhlala?" she asked hopefully.

"Muhlala," said Meris as positively as she could.

The big wet eyes looked at her accusingly and the little head said no, unmistakably, but she leaned against Meris, her weight suddenly doubling as she relaxed.

"Well now," said Mark. "Back to work."

"Work? Oh Mark!" Meris was contrite. "I've broken into your work day again!"

"Well, it's not every day I catch a child flying in the forest. I'll make it up—somehow."

Meris helped Mark get settled to his work and, dressing the child —"What's your name, honey? What's your name?"—in her own freshly dried clothes, she took her outside to leave Mark in peace.

"Muhlala!" said Meris, smiling down at the upturned wondering face. The child smiled and swung their linked hands.

"Muhlala!" she laughed.

"Okay," said Meris, "We'll call you Lala." She skoonched down to child height. "Lala," she said, prodding the small chest with her finger. "Lala!"

Lala looked solemnly down at her own chest, tucking her chin in tightly in order to see. "Lala," she said, and giggled. "Lala!"

The two walked towards the creek, Lala in the lead, firmly leashed by Meris' hand. "No flying,' she warned. "I can't interrupt Mark to have him fish you out of the treetops."

Lala walked along the creek bank, peering down into the romping water and keeping up a running commentary of unintelligible words. Meris kept up a conversation of her own, fitting it into the brief pauses of Lala's. Suddenly Lala cried out triumphantly and pointed. Meris peered down into the water.

"Well!" she cried indignantly, "Those darn boys! Dumping trash

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in our creek just because they're mad at Mark. Tin cans—"

Lala was tugging at her hand, pulling her towards the creek.

"Wait a bit, Lala," laughed Meris. "You'll fall us both into the water."

Then she gasped and clutched Lala's hand more firmly. Lala was standing on the water, the speed of the current ruffling it whitely against the sides of her tiny shoes. She was trying to tug Meris after her, across the water towards the metalic gleam by the other bank of the creek.

"No, baby," said Meris firmly, pulling Lala back to the bank. "We'll use the bridge." So they did and Lala, impatient of delay, tried to free her hand so she could run along the creek bed, but Meris clung firmly. "Not without me!" she said.

When they arrived at the place where the metallic whatever lay under the water, Meris put Lala down firmly on a big grey granite boulder, back from the creek. "*Stay* there." Then she turned to the creek. Starting to wade, sneakers and all into the stream, she looked back at Lala. The child was standing on the boulder visibly wanting to come. Meris shook her head. "*Stay* there," she repeated.

Lala's face puckered but she sat down again. '*Stay* there," she repeated unhappily.

Meris tugged and pulled at the metal, the icy bite of the creek water numbing her feet. "Must be an old hot water tank," she grunted as she worked to drag it ashore. "When could they have dumped it here? We've been home—"

The current caught the thing as it let go of the mud at the bottom of the creek. It rolled and almost tore loose from Meris' hands, but she clung, feeling a fingernail break, and, putting her back to the task, towed the thing out of the current into the shallows. She turned its gleaming length over to drain the water out through the rip down its side.

"Water tank?" she puzzled. "Not like any I ever—"

"Stay there?" cried Lala excitedly. "Stay there?" She was jumping up and down on the boulder.

Meris laughed. "Come here," she said, holding out her muddy hands. "Come here!" Lala came. Meris nearly dropped her as she staggered under the weight of the child. Lala hadn't bothered to slide down the boulder and run to her. She had launched herself like a little rocket, airbourne the whole distance.

She wiggled out of Meris' astonished arms and rummaging, head hidden in the metal capsule, came out with a triumphant cry, "Deeko! Deeko!" And she showed Meris her sodden treasure. It was a doll, a wet, muddy, battered doll, but a doll nevertheless, dressed in minature duplication of Lala's outer garment they had left in the cabin.

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Lala plucked at the wet folds of the doll's clothes and made unhappy noises as she wiped the mud from the tiny face. She held the doll up to Meris, her voice asking and coaxing. So Meris squatted down by the child and together they undressed Deeko and washed her and her tiny clothes in the creek then spread the clothes on the boulder in the sun. Lala gave Deeko a couple of soggy hugs, then put her on the rock also.

Just before supper, Mark came out to the creek-side to see the metallic object. He was still shaking his head in wonderment over the things Meris had told him of Lala. He would have discounted them about ninety per cent except that Lala did them all over again for him. When he saw the ripped cylinder, he stopped shaking his head and just stared for a moment. Then he was turning it, and exploring in it, head hidden, hefting the weight of it flexing a piece of its ripped metal. The he lounged against the grey boulder and lipped thoughtfully at a dry cluster of pine needles.

"Let's live dangerously," he said, "And assert that this is the How that Lala arrived in our vicinity last night. Let us further assert that it has no earthly origin. Therefore, let us, madly but positively, assert that this is a space capsule of some sort and Lala is an extra-terrestial."

"You mean," gasped Meris, "That Lala is a little green man! And that this is a flying saucer?"

"Well, yes," said Mark, "Inexact, but it conveys the general idea."

"But Mark! She's just a baby. She couldn't possibly have traveled all that distance alone—"

"I'd say also that she couldn't have traveled all that distance in this vehicle, either," said Mark. "Point one, I don't see anything resembling a motor or fuel container or even a steering device. Point two, there are no provisions of any kind—water or food—or even any evidence of an air supply."

"Then?" said Meris, deftly fielding Lala from the edge of the creek.

"I'd say—only as a guess—that this is a sort of life boat in case of a wreck. I'd say something happened in the storm last night and here's Lala, Castaway."

"Where did you come from, baby dear?" chanted Meris to the wiggly Lala. "The heavens opened and you were here?"

"They'll be looking for her," said Mark, "Whoever her people are. Which means they'll be looking for us." He looked at Meris and smiled. "How does it feel, Mrs. Edwards, to be looked for by denizens of Outer Space?"

"Should we try to find them?" asked Meris. "Should we call the sheriff?"

"I don't think so," said Mark.

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"Let's wait a day or so. They'll find her. I'm sure of it. Anyone who lost a Lala would comb the whole state, inch by inch, until they found her."

He caught up Lala and tossed her, squealing, into the air. For the next ten minutes Mark and Meris were lead a merry chase trying to get Lala down out of the trees! Out of the sky! She finally fluttered down into Meris' arms and patted her cheek with a puzzled remark of some kind.

"I suppose," said Mark, taking a relieved breath, "That's she's wondering how-come we didn't chase her up there. Well, small one, you're our duckling. Don't laugh at our unwebbed feet."

That evening Meris sat rocking a drowsy-eyed Lala to sleep. She reached to tuck the blanket closer about the small bare feet, but instead cradled one foot in her hand. "You know what, Mark," she said softly. "It's just dawned on me what you were saying about Lala. You were saying that this foot might have walked on another world! It just doesn't seem possible!"

"Well, try this thought, then." Mark pushed back from his desk, stretching widely and yawning. "If that world was very far away or their speed not too fast, that foot may never have touched a world anywhere. She may have been born en route."

"Oh, I don't think so," said Meris, "She knows too much about—about—*things* for that to be so. She knew to look *in* water for that—that vehicle of hers and she knew to wash her doll in running water and to spread clothes in the sun to dry. If she'd lived her life in space—"

"Hmm!" Mark tapped his mouth with his pencil. "You could be right, but there might be other explanations for her knowledge. But then, maybe the real explanation of Lala is a very pedestrian one."

Meris was awake again in the dark. She stretched comfortably and smiled. How wonderful to be able to awaken in the dark and smile—instead of slipping inevitably into the aching endless grief and despair. How pleasant to be able to listen to Mark's deep breathing and Lala's little murmur as she turned on the camp cot beside the bed. How warm and relaxing the flicker of firelight from the cast-iron stove patterning ceiling and walls dimly. She yawned and stopped in midstretch. What was that? Was that what had wakened her?

There was a guarded thump on the porch, a fumbling at the door, an audible breath and then, "Mr. Edwards! Are you there?" The voice was a forced whisper.

Meris' hand closed on Mark's shoulder. He shrugged away in his sleep, but as her fingers tightened, he came wide awake, listening.

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"Mr. Edwards!"

"Someone for Lala!" Meris gasped and reached towards the sleeping child.

"No," said Mark. "It's Tad Winstal." He lifted his voice. "Just a minute, Tad!" There was a muffled cry at the door and then silence. Mark padded barefoot to the door, blinking as he snapped the lights on, and, unlatching the door, swung it open. "Come on in, fellow, and close the door. It's cold." He shivered back for his jacket and sneakers.

Tad slipped in and stood awkwardly thin and lanky by the door, hugging his arms to himself convulsively. Mark opened the stove and added a solid chunk of oak.

"What brings you here at this hour?" he asked calmly.

Tad shivered. "It isn't you, then," he said, "But it's bad trouble. You told me that gang was no good to mess around with. Now I know it. Can they hang me for just being there?" His voice was very young and shaken.

"Come over here and get warm," said Mark. "For being where?"

"In the car when it killed the guy."

"Killed!" Mark fumbled the black lid lifter, "What happened?"

"We were out in the Porsche of Rick's, just tearing around seeing how fast it could take that winding road on the other side of Sheep's Bluff. Tad gulped. "They called me chicken because I got scared. And I am! I saw Mr. Stegemeir after his pickup went off the road by the fish hatchery last year and I—I can help remembering it. Well, anyway—" his voice broke off and he gulped. "Well, they made such good time that they got to feeling pretty wild and decided to come over on this road and—" his eyes dropped away from Mark's and his feet moved apologetically. "They wanted to find some way to get back at you again."

Then his words tumbled out in a wild spurt of terror. "All at once there was this man. Out of nowhere! Right in the road! And we hit him! And knocked him clear off the road. And they weren't even going to stop, but I grabbed the key and made them! I made them back up and I got out to look for the man. I found him. All bloody. Lying in the bushes. While I was trying to find out where he was bleeding—they—they went off and left me there with him!" His voice was outraged. "They didn't give a darn about that poor guy! They went off and left him lying there and me with not even a flashlight!"

Mark had been dressing rapidly. "He may not be dead," he said, reaching for his cap. "How far is he?"

"The other side of the creek bridge," said Tad. "We came the Rim way. Do you think he might —"

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"We'll see," said Mark. "Meris, give me one of those army blankets and get Lala off the cot. We'll use that for a stretcher. Build the fire up and check the first aid kit." He got the Coleman lantern from the store room, then he and Tad gathered up the canvas cot and went out into the chilly darkness.

Lala fretted a little, then, curled in the warmth Mark had left, she slept again through all the bustling about as Meris prepared for Mark's return.

Meris ran to the door when she heard their feet in the yard. She flung the outer door wide and held the screen as they edged the laden cot through the door. "Is he—?"

"Don't think so." Mark grunted as they lowered the cot to the floor. "Still bleeding from the cut on his head and I don't think dead men bleed. Not this long, anyway. Get a gauze pad, Meris, and put pressure on the cut. Tad, get his boots off while I get his shirt—"

Meris glanced up from her bandage as Mark's voice broke off abruptly. He was staring at the shirt. His eyes caught Meris' and he ran a finger down the front of the shirt. No buttons. Meris' mouth opened, but Mark shook his head warningly. Then, taking hold of the muddied shirt, he gently turned both sides back away from the chest that was visibly laboring now.

Meris' hands followed the roll of the man's head, keeping the bandage in place, but her eyes were on the bed where Lala had turned away from the light and was burrowed nearly out of sight under the edge of Mark's pillow.

Tad spoke from where he was struggling with the man's boots. "I thought it was you, Mr. Edwards," he said. "I nearly passed out when you answered the door. Who else could it have been? No one else lives way out here and I couldn't see his face. I knew he was bleeding because my hands—" he broke off as one boot thumped to the floor. "And we knocked him so far! So high! And I thought it was you!" He shuddered and huddled over the other boot. "I'm cured, honest, Mr. Edwards. I'm cured. Only don't let him die! Don't let him die!" He was crying now, unashamed.

"I'm no doctor," said Mark, "But I don't think he's badly hurt. Lots of scratches, but that cut on his head seems to be the worst."

"The bleeding's nearly stopped," said Meris. "And his eyes are fluttering."

Even as she spoke, the eyes opened, dark and dazed, the head turning restlessly. Mark leaned over the man. "Hello," he said, trying to get the eyes to focus on him. "You're okay. You're okay. Only a cut—"

The man's head stilled. He blinked and spoke, his eyes closing before his words were finished.

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"What did he say?" asked Tad, "What did he say?"

"I don't know," said Mark. "And he's gone again. To sleep, this time, I hope. I'm quite sure he isn't dying."

Later when Mark was satisfied that the man was sleeping in the warm pajamas he and Tad had managed to wrestle him into, he got dressed in clean clothes and had Tad wash up, and put on a clean flannel shirt in place of his blood-stained one.

"We're going to the sheriff, after we find the doctor," he told Tad. "We're going to have to take care of those kids before they do kill someone or themselves. And you, Tad, are going to have to put the finger on them whether you like it or not. You're the only witness—

"But if I do, then I'll get in trouble, too—" began Tad.

"Look, Tad," said Mark patiently, "If you walk in mud, you get your feet muddy. You knew when you got involved with these fellows that you were wading in mud. Maybe you thought it didn't matter much. Mud is easy to wash off. That might be true of mud, but what about blood?"

"But Rick's not a juvenile anymore—" Tad broke off before the grim tightning of Mark's face.

"So that's what they've been trading on. So he's legally accountable now? Nasty break!"

After they were gone, Meris checked the sleeping man again. Then, crawling into bed, shoving Lala gently towards the back of the bunk, she cuddled, shivering under the bedclothes. She became conscious of the steady outflow of warmth from Lala and smiled as she fanned her cold hands out under cover towards the small body. "Bless the little heater!" she said. Her eyes were sleepy and closed in spite of her; but her mind still raced with excitement and wonder. What if Mark was right? What if Lala had come from a space ship! What if this man, sleeping under their own blankets on their own cot, patched by their own gauze and adhesive, was really a Man from Outer Space! Wouldn't that be something? "But," she sighed, "No bug-eyed monsters? No set, staring eyes and slavering teeth?" She smiled at herself. She had been pretty bug-eyed herself, when she had seen his un-unbuttonable shirt. People are pretty much—people, anywhere.

Dr. Hilf arrived, large, loud and lively, before Meris got back to sleep—in fact, while she was in the middle of her *Bless Mark, bless Tad, bless Lala, bless the bandaged man, bless*—. He examined the silently cooperative man thoroughly, rebandaged his head and a few of the deeper scratches, grabbed a cup of coffee and boomed, "Doesn't look to me as if he's been hit by a car! Aspirin if his head aches. No use wasting stitches

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where they aren't needed!" His voice woke Lala and she sat up, blinking silently at him. "He's not much worried himself! Asleep already! That's an art!" The doctor gave Meris a practiced glance. "Looking half alive again yourself, young lady. Good idea having a child around. Your niece?" He didn't wait for an answer. "Good to help hold the place until you get another of your own!" Meris winced away from the idea. The doctor's eyes softened, but not his voice. "There'll be others," he boomed, "We need offspring from good stock like yours and Mark's. Leaven for a lot of the make-weights popping up all over." He gathered up his things and flung the door open. "Mark says the fellow's a foreigner. No English. Understood though. Let me know his name when you get it. Just curious. Mark'll be along pretty quick. Waiting for the Sheriff to get the juvenile officers from county seat." The house door slammed. A car door slammed. A car roared away. Meris automatically smoothed her hair, as she always did after a conversation with Dr. Hilf.

She turned wearily back toward the bunk. And gasping, stumbled forward. Lala was hovering in the air over the strange man like a flanneled angel over a tombstone crusader. She was peering down, her bare feet flipping up as she lowered her head toward him. Meris clenched her hands and made herself keep back out of the way.

"Muhlala!" whispered Lala, softly. Then louder, "Muhlala!" Then she wailed, "Muhlala!" and thumped herself down on the quiet, sleeping chest.

"Well," said Meris aloud to herself as she collapsed on the edge of the bunk. "There seems to be no doubt about it!" She watched—a little enviously—the rapturous reunion, and listened—more than a little curious—to the flood of strange sounding double conversation going on without perceptable pauses. Smiling, she brought tissues for the man to mop his face after Lala's multitude of very moist kisses. The man was sitting up now holding Lala closely to him. He smiled at Meris and then down at Lala. Lala looked at Meris and then patted the man's chest.

"Muhlala," she said happily, "Muhlala!" and burrowed her head against him.

Meris laughed. "No wonder you thought it funny when I called you Muhlala," she said. "I wonder what Lala means."

"It means 'daddy'" said the man. "She is quite excited about being called daddy."

Meris swallowed her surprise. "Then you do have English," she said.

"A little," said the man. "As you give it to me. Oh, I am Johannan:" He sagged then, and said something unEnglish to Lala. She pro-

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tested, but even protesting, lifted herself out of his arms and back to the bunk, after planting a last smacking kiss on his right ear. The man wiped the kiss away and held his drooping head between his hands.

"I don't wonder," said Meris, going to the medicine shelf. "Aspirin for your headache." She shook two tablets into his hand and gave him a glass of water. He looked bewilderedly from one hand to the other.

"Oh dear," said Meris. "Oh well, I can use one myself," and she took an aspirin and a glass of water and showed him how to dispose of them. The man smiled and gulped the tablets down. He let Meris take the glass, slid flat on the cot and was breathing asleep before Meris could put the glass in the sink.

"Well!" she said to Lala and stood her, curly-toed, on the cold floor and straightened the bedclothes. "Imagine a grown-up not knowing what to do with an aspirin! And now," she plumped Lala into the freshly made bed, "Now, my Daddy-girl, shall we try that instant sleep bit?"

The next afternoon, Meris and Lala lounged in the thin warm sunshine near the creek with Johannan. In the piney, waterloud clearing, empty of unnecessary conversation, Johannan drowsed and Lala alternately band-aided her doll and unband-aided it until all the stickum was off the tape. Meris watched her with the sharp awareness that comes so often before an unwished-for parting from one you love. Then, with an almost audible click, afternoon became evening and the shadows were suddenly long. Mark came out of the cabin, stretching his desk-kinked self widely, then walking his own long shadow down to the creek bank.

"Almost through," he said to Meris as he folded himself to the ground beside her. "By the end of the week barring fire or flood, I'll be able to send it off."

"I'm so glad," said Meris, her happiness welling strongly up inside her. "I was afraid my foolishness—"

"The foolishness is all past now," said Mark. "It is remembered against us no more."

Johannan had sat up at Mark's approach. He smiled now and said carefully, "I'm glad my child and I haven't interrupted your work too much. It would be a shame if our coming messed up things for you."

"You have a surprising command of the vernacular if English is not your native tongue," said Mark, his interest in Johannan suddenly sharpening.

"We have a knack for languages, smiled Johannan.

"How on earth did you come to lose Lala?" Meris asked, amazed at herself for asking such a direct question.

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Johannan's face sobered. "That was quite a deal—losing a child in a thunderstorm over a quarter of a continent." He touched Lala's cheek softly with his finger as she patiently tried to make the worn-out tape stick again on Deeka. "It was partly her fault," said Johannan, smiling ruefully. "If she weren't so precocious—. You see, we do not come into the atmosphere with the large ship—too many complications about explanations and misinterpretations and a very real danger from trigger-happy—or unhappy—military, so we use our life-slips for landings."

"We?" murmured Meris.

"Our People," said Johannan simply. "Of course there's no Grand Central Station of the Sky. We are very sparing of our comings and goings. Lala and I were returning because Lala's mother has been Called and it is best to bring Lala to Earth to her grandparents."

"Her mother was called?" asked Mark.

"Back to the Presence," said Johannan. "Our years together were very brief." His face closed smoothly over his sorrow. "We move our life-slips," he went on after a brief pause, "Without engines. It is an adult ability, to bring the life-slips through the atmosphere to land at the Canyon. But Lala is precocious in many Gifts and Persuasions and she managed to jerk her life-slip out of my control on the way down. I followed her into the storm—" he gestured and smiled. He had finished.

"But where were you headed?" asked Mark. "Where on Earth—?

"On Earth," Johannan smiled. "There is a Group of The People. More than one Group, they say. They have been here, we know, since the end of the last century. My wife was on Earth. She returned to the New Home on the ship we sent to Earth for the refugees. She and I met on the New Home. I am not familiar with Earth—that's why, though I was oriented to locate the Canyon from the air, I am fairly thoroughly lost to it from the ground."

"Mark," Meris leaned over and topped Mark's knee. "He thinks he has explained everything."

Mark laughed. "Maybe he has. Maybe we just need a few years for absorption and amplification. Questions, Mrs. Edwards?"

"Yes," said Meris, her hand softly on Lala's shoulder. "When are you leaving, Johannan?"

"I must first find the Group," said Johannan, "So, if Lala could stay—" Meris' hands betrayed her. "For a *little* while longer," he emphasized, "it would help."

"Of course," said Meris, "Not ours to keep."

"The boys," said Johannan suddenly. "Those in the car. There was a most unhealthy atmosphere. It was an accident, of course. I tried to lift out of the way. . . . But there was little concern—"

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"There will be," said Mark grimly, "Their hearing is Friday."

"There was one," said Johannan slowly, "Who felt pain and compassion—"

"Tad," said Meris. "He doesn't really belong—"

"But he associated—"

"Yes," said Mark, "Consent by silence—"

The narrow, pine-lined road swept behind the car, the sunlight flicking across the hood like pale, liquid pickets. Lala bounced on Meris' lap, making excited, unintelligible remarks about the method of transportation and the scenery going by the windows. Johannan sat in the back seat being silently absorbed in his new world. The trip to town was a three-fold expedition—to attend the hearing for the boys involved in the accident—to start Johannan on his search for the Group—and to celebrate the completion of Mark's manuscript.

They had left it blockily beautiful on the desk, awaiting the triumphant moment when it would be wrapped and sent on its way and when Mark would suddenly have large quantities of uncommitted time on his hands for the first time in years.

"What is it?" Johannan had asked.

"His book," said Meris. "A reference textbook for one of those frightening new fields that are in the process of developing. I can't even remember its name, let alone understand what it's about."

Mark laughed. "I've explained a dozen times. I don't think she wants to remember. The book's to be used by a number of universities for their textbook in the field *if*, if it can be ready for next year's classes. If it can't be available in time, another one will be used and all the concentration of years—" He was picking up Johannan's gesture.

"So complicated—" said Meris.

"Oh yes," said Johannan. "Earth's in the complication stage."

"Complication stage?" asked Meris.

"Yes," said Johannan. "See that tree out there? Simplicity says—a tree. Then wonder sets in and you begin to analyse it—cells, growth, structure, leaves, photosynthesis, roots, bark, rings—on and on until the tree is a mass of complications. Then, finally, with reservations not quite to be removed, you can put it back together again and sigh in simplicity once more—a tree. You're in the complication period in the world now."

"Is true!" laughed Mark. "Is true!"

"Just put the world back together again, someday," said Meris, soberly.

"Amen," said the two men.

But now the book was at the cabin and they were in town for a

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day that was remarkable for its widely scattered, completely unorganized confusion. It started off with Lala, in spite of her father's warning words, leaving the car through the open window, headlong, without waiting for the door to be opened. A half-a-block of pedestrians—five to be exact—rushed to congregate in expectation of blood and death, to be angered in their relief by Lala's laughter that lit her eyes and bounced her dark curls. Johannan snatched her back into the car—forgetting to take hold of her in the process—and un-Englished at her severely, his brief gestures making clear what would happen to her if she disobeyed again.

The hearing for the boys crinkled Meris' shoulders unpleasantly. Rick appeared with the minors in the course of the questioning and glared at Mark the whole time, his eyes flicking hatefully back and forth across Mark's face. The gathered parents were an unhappy, uncomfortable bunch, each over-reacting according to his own personal pattern and the boys either echoing or contradicting the reactions of their own parents. Meris wished herself out of the unhappy mess.

Midway in the proceedings, the door was flung open and Johannan, who had left with a wiggly Lala as soon as his small part was over, gestured at Mark and Meris and unEnglished at them across the whole room. The two left, practically running, under the astonished eyes of the judge and, leaning against the securely closed outside door, looked at Johannan. After he understood their agitation and had apologized in the best way he could pluck from their thoughts, he said,

"I had a thought," he shifted Lala, squirming, to his other arm. "The—the doctor who came to look at my head—he—he—" he gulped and started again. "All the doctors have ties to each other, don't they?"

"Why I guess so," said Meris, rescuing Lala and untangling her brief skirts from under her armpits. "There's a medical society—"

"That is too big," said Johannan after a hesitation. "I mean, Dr.—Dr.—Hilf would know other doctors in this part of the country?" His voice was a question.

"Sure he would," said Mark. "He's been around here since Territorial days. He knows everyone and his dog—including a lot of the summer people."

"Well," said Johannan, "There is a doctor who knows my People. At least there was. Surely he must still be alive. He knows the Canyon. He could tell me."

"Was he from around here?" asked Mark.

"I'm not sure where here is," Johannan reminded, "but a hundred miles or so one way or the other."

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"A hundred miles isn't much out here," confirmed Meris. "Lots of times you have to drive that far to get anywhere."

"What was the doctor's name?" asked Mark, snatching for Lala as she shot up out of Meris' arms in pursuit of a helicopter that clacked overhead. He grasped one ankle and pulled her down. Grim-faced, Johannan took Lala from him.

"Excuse me," he said, and, facing Lala squarely to him on one arm, he held her face still and looked at her firmly. In the brief silence that followed, Lala's mischievous smile faded and her face crumpled into sadness and then to tears. She flung herself upon her father, clasping him around his neck and wailing heart-brokenly, her face pushed hard against his shoulder. He unEnglished at her tenderly for a moment then said, "You see why it is necessary for Lala to come to her grandparents. They are Old Ones and know how to handle such precocity. For her own protection she should be among the People."

"Well, cherub," said Mark, retrieving her from Johannan, "Let's go salve your wounded feelings with an ice cream cone."

They sat at one of the tables in the back of one of the general stores and laughed at Lala's reaction to ice cream, then, with her securely involved with a glass full of crushed ice, they returned to the topic under discussion.

"The only way they ever referred to the doctor was just Doctor—"

He was interrupted by the front door slapping open. Shelves rattled. A can of corn dropped from a pyramid and rolled across the floor. "Darn fool summer people!" trumpeted Dr. Hilf. "Sit around all year long a sea-level getting exercise with a knife and fork then come roaring up here and try to climb Devil's Slide eleven thousand feet up in one morning!"

Then he saw the group at the table. "Well! How'd the hearing go?" he roared, making his way rapidly and massively toward them as he spoke. The three exchanged looks of surprise, then Mark said, "We weren't in at the verdict," he started to get up. "I'll phone—"

"Never mind," boomed Dr. Hilf. "Here comes Tad." They made room at the table for Tad and Dr. Hilf.

"We're on probation," confessed Tad. "I felt about an inch high when the judge got through with us. I've had it with that outfit!" He brooded briefly. "Back to my bike, I guess, until I can afford my own car. Chee!" He gazed miserably at the interminable years ahead of him. Maybe even five!

"What about Rick?" asked Mark.

"Lost his license," said Tad uncomfortably. "For six months, anyway. Gee, Mr. Edwards, he's sure mad at you now. I guess he's de-

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cided to blame you for everything."

"He should have learned long ago to blame himself for his own misdoings," said Meris. "Rick was a spoiled-rotten kid long before he ever came up here."

"Mark's probably the first one ever to make him realize that he was a brat," said Dr. Hilf. "That's plenty to build a hate on."

"Walking again!" muttered Tad. "So okay! So t'heck with wheels!"

"Well, since you've renounced the world, the flesh and Porsches," smiled Mark, "Maybe you could beguile the moments with learning about vintage cars. There's plenty of them still functioning around here."

"Vintage cars?" said Tad. "Never heard of them. Imports?"

Mark laughed, "Wait. I'll get you a magazine." He made a selection from the magazine rack in back of them and plopped it down in front of Tad. "There. Read up. There might be a glimmer of light to brighten your dreary midnight."

"Dr. Hilf," said Johannan, "I wonder if you could help me."

"English!" bellowed Dr. Hilf, "Thought you were a foreigner! You don't look as if you need help! Where's your head wound? No right to be healed already!"

"It's not medical," said Johannan. "I'm trying to find a doctor friend of mine. Only I don't know his name or where he lives."

"Know what *state* he lives in?" Laughter rumbled from Dr. Hilf.

"No," confessed Johannan, "But I do know he is from this general area and I thought you might know of him. He has helped my People in the past."

"And your people are—" asked Dr. Hilf.

"Excuse me, folks," said Tad, unwinding his long legs and folding the magazine back on itself. "There's my Dad, ready to go. I'm grounded. Gotta tag along like a kid. Thanks for everything—and the magazine." And he dejectedly trudged away.

Dr. Hilf was waiting for Johannan who was examining his own hands intently. "I know so little," said Johannan. "The doctor cared for a small boy with a depressed fracture of the skull. He operated in the wilderness with only the instruments he had with him." Dr. Hilf's eyes flicked to Johannan's face and then away again. "But that was a long way from where he found one of Ours who could make music and was going wrong because he didn't know who he was."

Dr. Hilf waited for Johannan to continue. When he didn't, the doctor pursed his lips and hummed massively.

"I can't help much," said Johannan, finally, "But are there so many doctors who live in the wilds of this area?"

"None," boomed Dr. Hilf. "I'm the farthest out—if I may use that loaded expression. Out in these

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parts, a sick person has three choices—die, get well on his own, or call me. Your doctor must have come from some town."

It was a disconsolate group that headed back up-canyon. Their mood even impressed itself on Lala and she lay silent and sleepy-eyed in Meris' arms, drowsing to the hum of the car.

Suddenly Johannan leaned forward and put his hand on Mark's shoulder. "Would you stop, please?" he asked. Mark pulled off the road onto the nearest available flat place, threading expertly between scrub oak and small pines. "Let me take Lala." And Lala lifted over the back of the seat without benefit of hands upon her. Johannan sat her up on his lap. "Our People have a highly developed racial memory," he said. "For instance, I have access to the knowledge any of our People have known since the Bright Beginning, and, in lesser measure, to the events that have happened to any of them. Of course, unless you have studied the technique of recall, it is difficult to take knowledge from the past, but it's there, available. I am going to see if I can get Lala to recall for me. Maybe her precocity will include recollection also." He looked down at his nestling child and smiled. "It won't be spectacular," he said, "No eyeballs will light up. I'm afraid it'll be tedious to you, especially since it will be sub-vocal. Lala's spoken vocabulary lags behind her other Gifts. You can drive on, if you like." And he leaned back with Lala in his arms. The two to all appearances were asleep.

Meris looked at Mark and Mark looked at Meris, and Meris felt an irrepressible bubble of laughter start up her throat. She spoke hastily to circumvent it.

"Your manuscript," she said.

"I got a box for it," said Mark, easing out onto the road again. "Chip found one for me when you took Lala to the restroom. Couldn't have done better if I'd had it made to measure. What a weight—" he yawned in sudden release, "What a weight off my mind. I'll be glad when it's off my hands, too. Thank God! Thank God it's finished!"

The car was topping the Rim when Johannan stirred, and a faint twitter of release came from Lala. Meris turned sideways to look at them inquiringly.

"May I get out?" asked Johannan. "Lala has recalled enough that I think my search won't be too long."

"I'll drive you back," said Mark, pulling up by the road.

"Thanks, but it won't be necessary." Johannan opened the door and, after a tight embrace for Lala and an unEnglish word or two, stepped out. "I have ways of going. If you will care for Lala until I return."

"Of course!" said Meris, reaching for the child who flowed over

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the back of the seat into her arms in one complete motion. "God bless, and return soon."

"Thank you," said Johannan and walked into the roadside bushes. They saw a ripple in the branches, the turn of a shoulder, the flick of a foot, one sharp startling glimpse of Johannan rising against the blue and white of the afternoon sky and then he was hidden in the top branches of the trees.

"Shoosh!" Meris slumped under Lala's entire weight. "Mark, is this a case of *folie a deux,* or is it really happening?"

"Well," said Mark, starting the car again. "I doubt if we two could achieve the same hallucinations simultaneously, so let's assume it's really happening."

When they finally reached the cabin and stopped the motor, they sat for a moment in the restful, active silence of the hills. Meris, feeling the soft warmth of Lala against her and the precious return of things outside herself, shivered a little remembering her dead self who had stared so blankly so many hours out of the small windows, tearlessly crying, soundlessly wailing, wrapped in misery. She laughed and hugged Lala. "Maybe we should get a leash for this small person," she said to Mark. "I don't think I could follow in Johannan's footsteps."

"Supper first," said Mark as he fumbled with the padlock on the cabin door. He glanced, startled, back over his shoulder at Meris. "It's broken," he said, "Wrenched open—". He flung the door open hastily, and froze on the doorstep. Meris pushed forward to look beyond him.

Snow had fallen in the room—snow covered everything—a smudged, crumpled snow of paper, flour, sugar and detergent. Every inch of the cabin was covered by the tattered, soaked, torn, crumpled snow of Mark's manuscript! Mark stooped slowly, like an old man, and took up one page. Mingled detergent and maple syrup clung, clotted, and slithered off the edge of one of the diagrams that had taken two days to complete. He let the page fall and shuffled forward, ankle deep in the obscene, incredible chaos. Meris hardly recognized the face he turned to her.

"I've lost our child again," he said tightly. "This—" he gestured at the mess about them, "This was my weeping and my substitute for despair. My creation to answer death." He backhanded a clutter of papers off the bunk and slumped down until he lay, face to the wall, motionless.

Mark said not a word nor turned around in the hours that followed. Meris thought perhaps he slept at times, but she said nothing to him as she cautiously scrabbled through the mess in the cabin. She found, miraculously undamaged, a chap-

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ter and a half of pages under the cupboard. With careful hands she salvaged another sheaf of papers from where they had sprayed across the top of the cupboard. All the time she searched and sorted through the mess in the cabin. All the time she searched, Lala sat, unnaturally well-behaved and solemn and watched her, getting down only once to salvage Deeko from a mound of sugar and detergent, clucking unhappily as she dusted the doll off.

It was late and cold when Meris put the last ruined sheet in the big cardboard box they had carried groceries home in, and the last salvagable sheet on the desk. She looked silently at the clutter in the box and the slender sheaf on the desk, shivered and turned to build up the dying fire in the stove. Her mouth tightened and the sullen flicker of charring, wadded paper in the stove painted age and pain upon her face. She stirred the embers with the lid-lifter and rebuilt the fire. She prepared supper, fed Lala and put her to bed. Then she sat on the edge of the lower bunk by Mark's rigid back and touched him gently.

"Supper's ready," she said, "Then I'll need some help in scrubbing up—the floor, the walls, the furniture." She choked on a sound that was half laughter and half sob. "There's plenty of detergent around already. We may bubble ourselves out of house and home."

For a sick moment she was afraid he wouldn't respond. *Just like I was,* she thought achingly, *Just like I was!* Then he sat up slowly, brushed his arm back across his expressionless face and his rumpled hair, and stood up.

When they finally threw out the last bucket of scrub water and hung out the last scrub rag, Meris rubbed her water-wrinkled hands down her weary sides and said, "Tomorrow we'll start on the manuscript again."

"No," said Mark. "That's all finished. The boys got carbon-copy and all. It would take weeks for me to do a rewrite if I could ever do it. We don't have weeks. My leave of absence is over, and the deadline for the manuscript is this next week. We'll just have to chalk this up as lost. Let the dead past bury the dead."

He went to bed, his face turned again from the light. Meris, through the blur of her slow tears, gathered up the crumpled pages that had pulled out with the blankets from the back of the bunk, smoothed them onto the salvage pile and went to bed, too.

For the next couple of days Mark was like an old man. He sat against the cabin wall in the sun, his arms resting on his thighs, his hands dangling from limp wrists, looking at the nothing that the senile and finished find on the ground. He moved slowly and reluctantly to the table to push his

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food around, to bed to lie, hardly breathing, but wide-eyed in the dark, to whatever task Meris set him, forgetting in the middle of it what he was doing.

Lala followed him at first, chattering unEnglish at her usual great rate, leaning against him when he sat, peering into his indifferent face. Then she stopped talking to him and followed him only with her eyes. The third day she came crying into Meris' arms and wept heart-brokenly against her shoulder.

Then her tears stopped, glistened on her cheeks a moment and were gone. She squirmed out of Meris' embrace and trotted to the window. She pushed a chair up close to the wall, climbed up on it, pressed her forehead to the chilly glass and stared out into the late afternoon.

Tad came over on his bike, bubbling over with the new idea of old cars.

"Why, there's parts of a whole bunch of these cars all over around here—" he cried, fluttering the tattered magazine at Mark. "And have you seen how much they're asking for some of them! Why I could put my self through college on used parts out of our old dumps! And some of these vintage jobs are still running around here! Kiltie has a model A—you've seen it! He shines it like a new shoe every week! And there's an old Overland touring car out in back of our barn, just sitting there, falling apart—"

Mark's silence got through to him then, and he asked, troubled, "What's wrong? Are you mad at me for something?"

Meris spoke into Mark's silence. "No, Tad, it's nothing you've done —" She took him outside, ostensibly to help bring in wood to fill the woodbox and filled him in on the events. When they returned, loaded down with firewood, he dumped his armload into the box and looked at Mark.

"Gee whizz, Mr. Edwards. Uh; —uh—gee whiz!" He gathered up his magazine and his hat and, shuffling his feet for a moment said, "Well, 'bye now," and left, grimacing back at Meris, wordless.

Lala was still staring out the window. She hadn't moved or made a sound while Tad was there. Meris was frightened.

"Mark!" She shook his arm gently. "Look at Lala. She's been like that for almost an hour. She pays no attention to me at all. Mark!"

Mark's attention came slowly back to the cabin and to Meris.

"Thank goodness!" she cried. "I was beginning to feel that I was the one that was missing!"

At that moment, Lala plopped down from the chair and trotted off to the bathroom, a round red spot marking her forehead where she had leaned so long.

"Well!" Meris was pleased. "It must be supper time. Everyone's

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gathering around again." And she began the bustle of supper-getting. Lala trotted around with her, getting in the way, hindering with her help.

"No, Lala!" said Meris, "I told you once already. Only three plates. Here, put the other one over there." Lala took the plate; waited patiently until Meris turned to the stove, then, lifting both feet from the floor, put the plate back on the table. The soft click of the flatware as she patterned it around the plate, caught Meris' attention. "Oh, Lala!" she cried, half-laughing, half-exasperated. "Well, all right. If you can't count, okay. Four it will be." She started convulsively and dropped a fork as a knock at the door roused even Mark. "Hungry guest coming," she laughed nervously as she picked up the fork, "Well, stew stretches."

She started for the door, fear, bred of senseless violence, crisping along her spine, but Lala was ahead of her, fluttering like a bird, with excited bird-cries, against the door panels, her hands fumbling at the knob and the night chain Meris had insisted on installing. Meris unfastened and unlocked and opened the door.

It was Johannan, anxious-eyed and worried, that slipped in and gathered up a shrieking Lala. When he had finally unEnglished her to a quiet, contented clinging, he turned to Meris. "Lala called me back," he said. "I've found my Group. She told me Mark was sick —*that bad things had happened.*"

"Yes," said Meris, stirring the stew and moving it to the back of the stove. "The boys came while we were gone and ruined Mark's manuscript beyond salvage. And Mark—Mark is crushed. He lost all those months of labor through senseless, vindictive—" she turned away from Johannan's questioning face and stirred the stew again, blindly.

"But," protested Johannan. "If once it was written, he has it still. He can do it again."

"Time is the factor." Mark's voice, rusty and harsh, broke in on Johannan. "And to re-write from my notes—" He shook his head and sagged again.

"But—but—!" cried Johannan still puzzled, putting Lala to one side where she hovered, sitting on air, crooning to Deeko, until she drifted slowly down to the floor. "It's all there! It's been written! It's a whole thing! All you have to do is put it again on paper. Your wordscriber—"

"I *don't* have total recall," said Mark. "Even if I did, just to put it on paper again—come see our 'wordscriber'." He smiled a small bent smile as Johannan poked fingers into the mechanism of the typewriter and clucked unhappily, sounding so like Lala that Meris almost laughed. "Such slowness! Such complications!"

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Johannan looked at Mark. "If you want, my People can help you get your manuscript back again."

"It's finished," said Mark. "Why agonize over it any more?" He turned to the dark window.

"Was it worth the effort of writing?" asked Johannan.

"I thought so," said Mark. "And others did, too."

"Would it have served a useful purpose?" asked Johannan.

"Of course it would have!" Mark swung angrily from the window. "It covered an area that needs to be covered. It was new—the first book in the field!" He turned again to the window.

"Then," said Johannan simply, "We will make it again. Have you paper enough?"

Mark swung back, his eyes glittering. Meris stepped between his glare and Johannan. "This summer I have come back from the dead," she reminded. "And you caught a baby for me, pulling her down from the sky by one ankle. Johannan went looking for his people through the tree-tops. And a three-year-old called him back by leaning against the window. If all these things could happen, why can't Johannan bring your manuscript back?"

"But if he tries and can't—" Mark began.

"*Then* we can let the dead past bury the dead," said Meris sharply, "Which little item you have not been letting happen so far!"

Mark stared at her then flushed a deep, painful flush. "Okay, then," he said. "Stir the bones again! Let him put meat back on them if he can!"

The next few hours were busy with patterned confusion. Mark roared off through the gathering darkness to persuade Chip to open the store for typing paper. And people arrived. Just arrived, smiling, at the door, familiar friends before they spoke, and Meris, glancing out to see if the heavens themselves had split open from astonishment saw, hovering tree-top-high, a truly vintage car, an old pickup that clanked softly to itself, spinning a wheel against a branch as it waited. "If Tad could see that!" she thought, with a bubble of laughter nudging her throat.

She hurried back indoors to further make welcome the newcomers —Valancy, Karen, Davy, Jemmy. The women gathered Lala in with soft cries and shining eyes and she wept briefly upon them in response to their emotions, then leaped upon the fellows and nearly strangled them with her hugs.

Johannan briefed the four in what had happened and what was needed. They discussed the situation, glanced at the few salvaged pages on the desk and sent, eyes closed briefly, for someone else. His name was Remy and he had a special 'Gift' for plans and diagrams. He arrived just before Mark

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got back, so the whole group of them confronted him when he flung the door open and stood there with his bundle of paper.

He blinked, glanced at Meris, then, shifting his burden to one arm, held out a welcoming hand. "I hadn't expected an invasion," he smiled. "To tell the truth, I didn't know what to expect." He thumped the package down on the table and grinned at Meris. "Chip's sure now that writers are psychoes," he said. "Any normal person could wait till morning for paper or use flattened grocery bags!" He shrugged out of his jacket. "Now."

Jemmy said, "It's really quite simple. Since you wrote your book and have read it through several times, the things exists as a whole in your memory, just as it was on paper. So all we have to do is put it on paper again." He gestured.

"That's *all?*" Mark's hands went back through his hair. "That's *all?* Man, that's all I had to do after my notes were organized, months ago! Maybe I should have settled for flattened grocery bags! Why, the sheer physical—" The light was draining out of his face.

"Wait—wait!" Jemmy's hand closed warmly over his sagging shoulder. "Let me finish.

"Davy, here, is our gadgeteer. He dreams up all kinds of knick-knacks and among other things, he has come forth with a wordscriber. Even better—" he glanced at Johannan, "Than the ones brought from the New Home. All you have to do is think and the scriber writes down your thoughts. "Here —try it—" he said into Mark's very evident skepticism.

Davy put a piece of paper on the table in front of Mark and, on it, a small gadget that looked vaguely like a small sanding block in that it was curved across the top and flat on the bottom. "Go on," urged Davy, "Think something. You don't even have to vocalize. I've keyed it to you. Karen sorted your setting for me."

Mark looked around at the interested, watching faces, at Meris' eyes, blurred with hesitant hope and then down at the scriber. The scriber stirred, then slid swiftly across the paper, snapping back to the beginning of a line again, as quick as thought. Davy picked up the paper and handed it to Mark. Meris crowded to peer over his shoulder.

Of all the darn-fool things! As if it were possible—Look at the son-of-a-gun go!

All neatly typed, neatly spaced, appropriately punctuated. Hope flamed up in Mark's eyes. "Maybe so," he said, turning to Jemmy, "What do I do, now?"

"Well," said Jemmy. "You have your whole book in your mind, but a mass of other things, too. It'd be almost impossible for you to think through your book without any digressions or side thoughts, so Karen will blanket

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your mind for you except for your book—"

"Hypnotism—" Mark's withdrawal was visible.

"No," said Karen. "Just screening out interference. Think how much time was taken up in your original draft by distractions—"

Meris clenched her hands and gulped, remembering all the hours Mark had had to—to *baby-sit* her while she was still rocking her grief like a rag doll with all the stuffings pulled out. She felt an arm across her shoulders and turned to Valancy's comforting smile. "All over," said her eyes, kindly, "All past."

"How about all the diagrams —" suggested Mark, "I can't verbalize—"

"That's where Remy comes in," said Jemmy, "All you have to do is visualize each one. He'll have his own scriber right here and he'll take it from there."

The cot was pulled up near the table and Mark disposed himself comfortably on it. The paper was unwrapped and stacked all ready. Remy and Davy arranged themselves strategically. Surrounded by briefly bowed heads, Jemmy said, "We are met together in Thy name." Then Karen touched Mark gently on the forehead with one finger tip.

Mark suddenly lifted himself on one elbow. "Wait," he said, "Things are going too fast. Why—why are you doing this for us, anyway. We're strangers. No concern of yours. Is it to pay us for taking care of Lala? In that case—"

Karen smiled. "Why *did* you take care of Lala? You could have turned her over to the authorities. A strange child, no relation, no concern of yours."

"That's a foolish question," said Mark. "She needed help. She was cold and wet and lost. Anyone—"

"You did it for the same reason we are doing this for you," said Karen. "Just because we originated on a different world, doesn't make us of different flesh. There are no strangers in God's universe. You found an unhappy situation that you could do something about, so you did it. Without stopping to figure out the whys and wherefores. You did it just because that's what love does."

Mark lay back on the narrow pillow. "Thank you," he said. Then he turned his face to Meris. "Okay?"

"Okay." Her voice jerked a little past her emotion. "*Love* you, Mark!"

"*Love* you, Meris!"

Karen's finger tip went to Mark's forehead again. "I need contact," she said a little apologetically, "Especially with an Outsider."

Meris fell asleep, propped up on the bunk, eyes lulled by the silent *sli-i-i-ide, flip! sli-i-i-ide, flip!* of the scriber, and the brisk flutter of finished pages from the tall pile

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of paper to the short one. She opened drowsy eyes to a murmur of voices and saw that the two piles of paper were almost balanced. She sat up to ease her neck where it had been bent against the cabin wall.

"But it's wrong, I tell you!" Remy was waving the paper. "Look, this line, here, where it goes—"

"Remy," said Jemmy, "Are you sure it's wrong or is it just another earlier version of what we know now?"

"No!" said Remy, "This time it's not that. This is a real mistake. He couldn't possibly have meant it to be like that—"

"Okay," Jemmy nodded to Karen and she touched Mark's forehead. He opened his eyes and half sat up. The scriber flipped across the paper and Karen stilled it with a touch. "What is it?" he asked, "Something go wrong?"

"No, it's this diagram," Remy brought it to him. "I think you have an error here. Look where this goes—"

The two bent over the paper. Meris looked around the cabin. Valancy was rocking a sleeping Lala in her arms. Davy was sound asleep in the upper bunk. At least his dangling leg looked very asleep. Johannan was absorbed in two books simultaneously. He seemed to be making a comparison of some sort. Meris lay back again, sliding down to a more comfortable position. For the first time in months and months the cabin was lapped from side to side with peace and relaxation. Even the animated discussion going on was no ruffling of the comfortable calmness. She heard, on the edge of her ebbing consciousness—

"Why no! That's not right at all!" Mark was astonished. "Hoo boy! If I'd sent that in with an error like that! Thanks, fella—" And sleep flowed over Meris.

She awoke later to the light chatter of Lala's voice and opened drowsy eyes to see her trailing back from the bathroom, her feet tucked up under her gown away from the chilly floor as she drifted back to Valancy's arms. The leg above Meris' head swung violently and withdrew, to be replaced by Davy's dangling head. He said something to Lala. She laughed and lifted herself up to his outstretched arms. There was a stirring around above Meris' head before sleeping silence returned.

Valancy stood and stretched.

She moved over to the table and thumbed the stack of paper.

"Going well," she said softly.

"Yes," said Jemmy, "I feel a little like a mid-wife, snatching something new-born in the middle of the night."

"Darn shame to stop here, though," said Remy. "With such a good beginning—oh, barring a few excursions down dead-ends—if we could only tack on a few more chapters."

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"Uh-uh!" Jemmy stood and stretched, letting his arms fall around Valancy's shoulders. "You know better than that—"

"Not even one little hint?"

"Not even." Jemmy was firm.

Sleep flowed over Meris again until pushed back by Davy's sliding over the edge of the upper bunk.

"Right in the stomach!" he moaned as he dropped to the floor. "Such a kicking kid I never met. How'd *you* survive?" he asked Valancy.

"Nary a kick," she laughed. "Technique—that's what it takes."

"I was just wondering," said Davy opening the stove and probing the coals before he put in another chunk of oak. "That kid Johannan was talking about—the one that's got interested in vintage cars. What about that place up on Bearcat Flat? You know, that little box canyon where we put all our old jalopies when we discarded them. Engines practically unused. Lifting's cheaper and faster. Of course the seats and the trunk beds are kinda beat up, and the paint. Trees scratch the daylights out of paint. How many are there there? Let's see. The first one was about 19-ought-something—"

Johannan looked up from his books. "He said something about selling parts or cars to get money for college—"

"Or restoring them!" Davy cried. "Hey, that could be fun! If he's the kind that would—"

"He is," said Johannan and went back to his reading.

"It's almost daylight." Davy went to the window and parted the curtains. "Wonder how early a riser he is?"

Meris turned her back to the light and slid back under sleep again.

Noise and bustle filled the cabin.

Coffee was perking fragrantly, eggs cracking, bacon spitting itself to crispness. Remy was cheerfully mashing slices of bread down on the hot stove lid and prying up the resultant toast. Lala was flicking around the table, putting two forks at half the places and two knives at the others then giggling her way back around with redistribution after Johannan pointed out her error.

Meris, reaching for a jar of peach marmalade on the top shelf of the cupboard, wondered how a day could feel so new and so wonderful. Mark sat at his desk opening and closing the box wherein lay the finished manuscript. He opened it again and fingered the top edge of the stack. He caught Jemmy's sympathetic grin and grinned back.

"Just making sure it's really there," he explained. "Magic put it in there. Magic might take it out again."

"Not this magic. I'll even ride shotgun for you into town and see

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that it gets sent off okay," said Jemmy.

"Magic or no," said Mark, sobering, "Once more I can say, Thank God! Thank God it's done!"

Tad was an early riser. He was standing under the hovering pickup, gaping upwards in admiring astonishment.

"Oops!" said Davy, with a sidewise glance at Jemmy. Tad was swept up in a round of introductions during which the pickup lowered slowly to the ground.

Tad turned from the group back to the pickup. "Look at it!" he said. "It must be at least 40 years old!" His voice pushed its genesis back beyond the pyramids.

"At least that," said Davy. "Wanta see the motor?"

"Do I!" He stood by impatiently as Davy wrestled with the hood. Then he blinked. "Hey! How did it get way up there? I mean, how'd it get down—"

"Look," said Davy hastily, "See this goes to the spark—"

The others, laughing, piled into Mark's car and drove away from the two absorbed buffs-in-embryo.

The car pulled over onto a pine flat halfway back from town and the triumphantal mailing of the manuscript. This was the parting place. Davy would follow later with the pickup.

"It's over," said Meris, her shoulders sagging a little as she put Lala's small bundle of belongings into Valancy's hands.

"Only this little episode," comforted Valancy. "It's really only begun." She put Lala into Meris' arms. "Tell her goodbye, Lala."

"It's just that she filled up the empty places so wonderfully well," she explained to Valancy.

"Yes," said Valancy softly, her eyes tender and compassionate, "But, you know," she went on. "You *are* pregnant again!"

Before Meris could produce an intelligible thought, goodbyes were finished and the whole group was losing itself in the tangle of creek-side vegetation. Lala's vigorous waving of Deeko was the last sign of them before the leaves closed behind them.

Meris and Mark stood there, Meris' head pressed to Mark's shoulder, both too drained for any emotion. Then Meris stirred and moved towards the car, her eyes suddenly shining. "I don't think I can wait," she said, "I don't think —"

"Wait for what?" asked Mark, following her.

"To tell Dr. Hilf—" She covered her mouth, dismayed. "Oh, Mark! We never did find out that Doctor's name!"

"Not that Hilf is drooling to know," said Mark, starting the car, "But next time—"

"Oh, yes," Meris sat back, her mouth curving happily, "Next time, next time!" ◀

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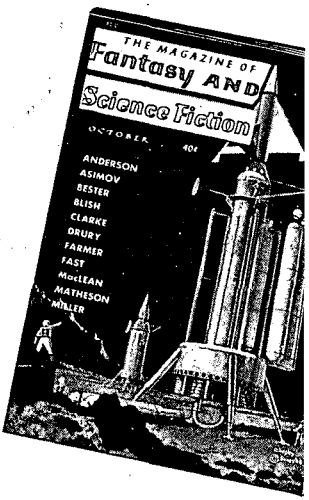

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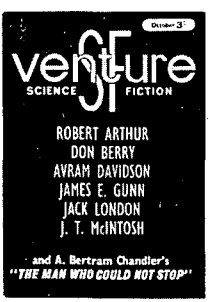

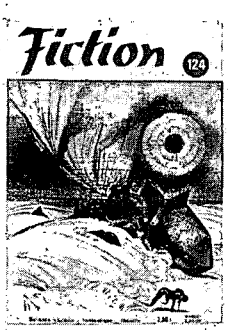

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